MAY • 1945

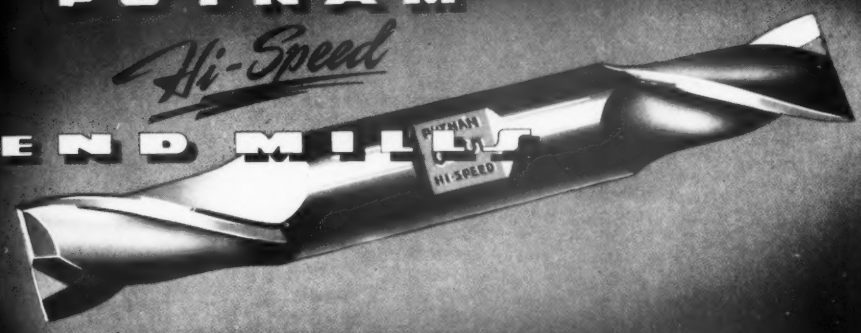
TOOL & DIE JOURNAL

DESIGN, MANUFACTURE AND USE OF PRODUCTION TOOLING

PUTNAM

Hi-Speed

END MILLS



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PUTNAM TOOL CO.

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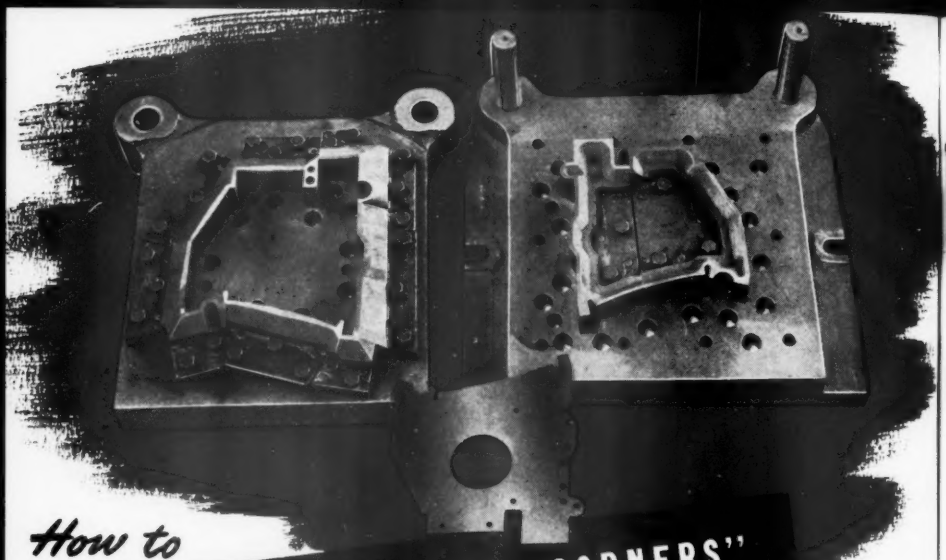

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It contains a print showing the various standard shapes available for quick shipment, and explains how to order special shapes, including rib-reinforced extra high sections. It also contains prices. Get your copy—write for it today.

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COMPLETELY
COLD
FORGED

← Etched, cutaway view of Holo-Krome Socket Head Cap Screw showing Continuous Fibrous Structure.

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SOCKET SCREWS

Completely Cold Forging method patented, owned and controlled by Holo-Krome.

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The sensational new ARO Model 7000 Screw Driver is no bigger than the average cigar! A "feather-weight" performer with big power . . . weighs only 8 oz. . . . is 4⅞" long and ¾" in diameter. Capacity No. 1 to No. 6 screws. Starts automatically—no manual throttle. Just touch it to the work and *presto*—the screw is driven!

Whatever your need in power tools . . . for screw-driving, nut-setting, drilling, grinding and scores of other production jobs . . . specify ARO! Precision-built for top-speed, trouble-free performance. Write for catalog. The Aro Equipment Corp., Bryan, Ohio.

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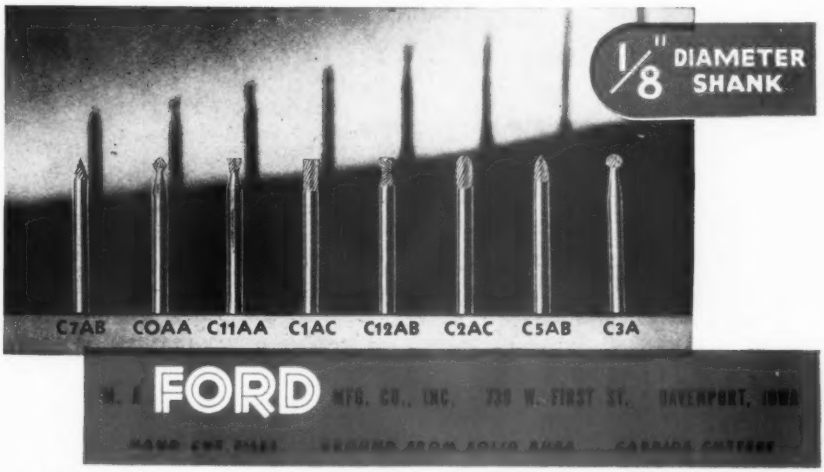
MINIATURE SOLID CARBIDE BURRS

Ford Miniature Carbide Burrs, ground from solid 1/8" tungsten carbide blanks, are available in eight standard shapes, to meet the most exacting demands for production precision operations.

Ford Miniature Solid Carbide Burrs cut with an accuracy and at a speed never before thought possible. Today more metal can be removed at high speeds with carbides than with any other material. For satisfactory performance these burrs should be operated at 20,000 r.p.m. and higher. These 1/8" shank burrs are available singly or in sets.



Specifications

WELLS No. 8

CAPACITY:

Rectangular . . . 8"x16" (Special Guides) . 5"x24"

ROUNDS: . 8" Diameter

MOTOR: . . ½ H. P.

SPEEDS: Selective 60, 90, 130 feet per minute

WEIGHT: Approximately 750 pounds

● This Wells Metal Cutting Band Saw is indeed a handy tool. It cuts metal, fibre, plastics and other materials. Easy to use. Easy to move from one job to another. Saves time and labor, occupies little floor space . . . A Wells No. 8 will pay for itself in short order.

You can use it for odd metal-cutting jobs in every part of the plant, or, equipped with a Wells Wet-Cutting System, you can use it for continuous production cutting.

Today, there are thousands of Wells saws in use . . . proof enough of their usefulness in every kind and size metal-working plant. Where can *you* use a Wells No. 8?

Wells saws

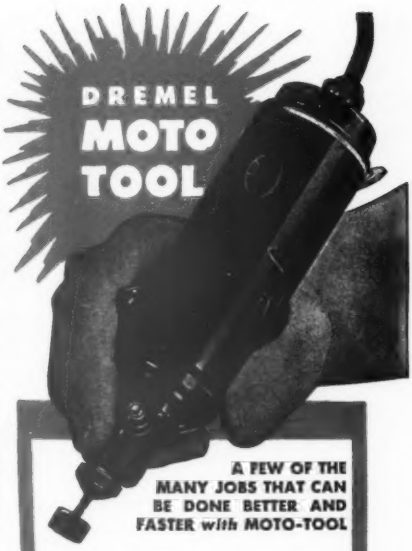
Wells

Products by Wells are Practical

METAL CUTTING BAND SAWS

WELLS MANUFACTURING CORPORATION
1940 ASH STREET, THREE RIVERS, MICH.

A 'WAR VETERAN' *with a distinguished Service Record*



Long before Pearl Harbor, the Dremel MOTO-TOOL won its spurs by the way it tackled tough jobs in tool rooms and machine shops, and on production lines. But when American industry swung its full strength into war production and our armed forces established far-flung assembly and repair bases the already healthy demand for these mighty little midgets quadrupled.

Operators of Moto-Tools are ever discovering new jobs . . . new ways to save time and cut costs . . . with these pocket size machine shops. Girls quickly become proficient with them because a Moto-Tool weighs but 13 ounces, is shaped to fit the hand, has a balanced armature to prevent vibration. Moto-Tools helped make the atomic bomb . . . were used to establish production records in plants such as General Electric, Westinghouse, Remington Arms, Ford, Nash-Kelvinator, Consolidated Aircraft, Northrup, Douglas, and many others.

A FEW OF THE MANY JOBS THAT CAN BE DONE BETTER AND FASTER *with* MOTO-TOOL

☐ Sharpening	☐ Burring	☐ Cleaning
☐ Finishing	☐ Grinding	☐ Routing
☐ Touching-Up	☐ Polishing	☐ Cutting
☐ Sanding	☐ Burnishing	☐ Rasping
☐ Drilling	☐ Inlaying	☐ Carving
☐ Mortising	☐ Sawing	☐ Brushing
☐ Engraving	☐ Scoring	☐ Dressing

Model 2 Moto-Tool, complete with 23 accessories, in felt-lined hard wood case . . . **$23.50.** Model 2 Moto-Tool only, with one emery wheel point . . . **$16.50.**

Model 2 Moto-Tool develops 27,000 rpm . . . the proper speed for clean, smooth, accurate work, and long life from points and cutters. It is sturdily built throughout and has a shock-proof bakelite housing and oil-less (oil sealed) bearings. Uses 110-120 volt AC or DC current. Ask your Mill Supply salesman about Dremel Moto-Tools and accessories. If his firm does not carry them, write factory or nearest Dremel representative.

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GRINDING IRREGULAR CONTOURS
on hardened DIES, PUNCHES, PARTS, with

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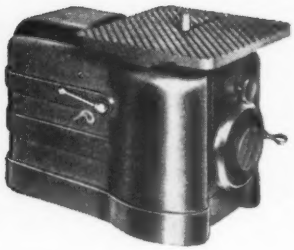
PROFILE GRINDERS



NO. 1 BENCH MODEL

A fast operating, precision Machine Tool for saving time in grinding difficult contours, and irregular shapes and profiles. In production as well as in tool and die work, it performs quickly, much of the tedious work formerly requiring hours of hand time.

Spindle speed of 20,000 R.P.M. with vertical oscillation assures rapid stock removal, even with wheels of small diameter. Accommodates wheels 1/8" to 1" diameter.

NO. 2 DUAL SPINDLE FLOOR MODEL

A precision Machine Tool, designed for larger and heavier work, grinding contours and irregular shapes. This dual spindle model is really two machines in one. Spindles are independently powered and operate at 10,000 R.P.M. with vertical oscillations. Stock removal is rapid with wheels as small as 1/2" diameter. Accommodates wheels 1/2" to 3" diameter.

NO. 2 SINGLE SPINDLE FLOOR MODEL

Exactly the same as the Dual Spindle Model except without the upper spindle, which may be added at any time if desired. A favorite Machine Tool in Tool and Die Shops.

WRITE FOR LITERATURE

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Uniform precision—accuracy—interchangeability of parts—those are the things that make possible the economy of modern streamline production.

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Gages bearing the PM Diamond Emblem are made to laboratory standards to begin with. Then they are given the smooth, hard finish that insures longer service.

We maintain large stocks of PM standard plug, ring and thread gages, as shown in the PM Catalog, and can give you immediate delivery service.

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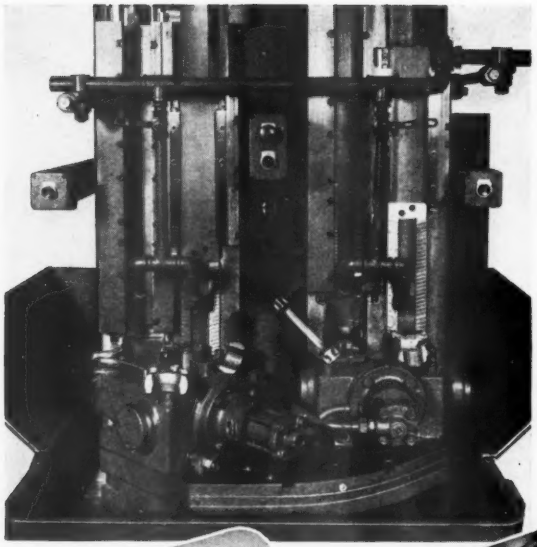
ARMY E NAVY
The PIPE MACHINERY COMPANY Cleveland, O.
GAGES • MULTIPLE THREAD MILLING CUTTERS • SPECIAL TOOLS



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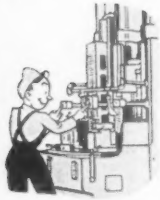
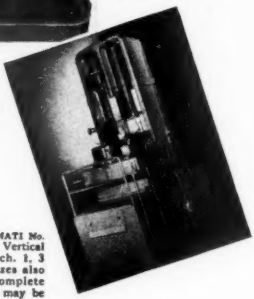


The *left-hand* fixture has been unloaded and properly reloaded and the cycle will continue.

Above: Broaching piston rods and caps on a CINCINNATI No. 5-54 Duplex Vertical Hydro-Broach Machine



CINCINNATI No. 10-66 Duplex Vertical Hydro-Broach. 1, 3 and 5 ton sizes also available. Complete specifications may be obtained by writing for Catalog M-1387. Sweet's Catalog File contains a brief description.

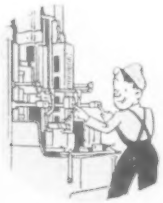
Rear view of fixture in loading position.

THE CINCINNATI

MILLING MACHINES

new features—

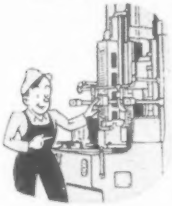
PRE-SET CYCLE CONTROL, AND HYDRAULICALLY OPERATED FIXTURES . . . COMBINE TO BOOST PRODUCTION



The *right-hand* fixture has been unloaded and properly reloaded, and the cycle will continue.

Broaching several surfaces of rods and caps at the rate of 325 pairs per hour (that's 650 parts) is a lot of production for one machine and one operator, but it's being done with this CINCINNATI No. 5-54 Duplex Vertical Hydro-Broach, tooled up by Cincinnati Application Engineers. Two new features make this production possible:

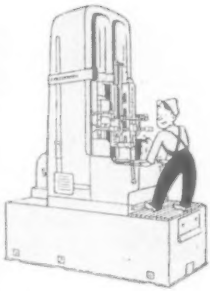
1) *Pre-Set Cycle Control*—It gives the operator added confidence; it's safer, and it eliminates any possibility of "crack-ups" The rams do not descend on their cutting stroke until the operator presses the button.



Operator reconsiders because work did not line up properly, and he does not want the ram to descend. He stops the cycle

2) *Hydraulically Operated Fixtures*—They clamp and unclamp *automatically* with even and consistent hydraulic pressure.

These two features are available with CINCINNATI Vertical Hydro-Broach Machines. Then there are many other features you'll be interested in, and which help to give these machines top rating as cost-reducing equipment. May we tell you more about them?

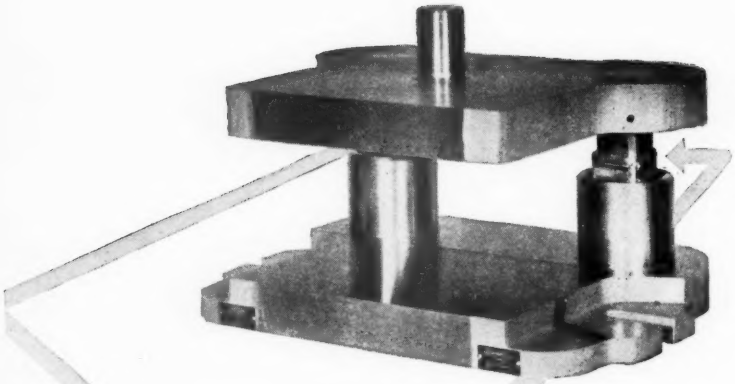


Operator stops complete machine at end of cycle by stepping on treadle.

CINCINNATI

MILLING MACHINE CO. CINCINNATI 9, OHIO, U.S.A.

BROACHING MACHINES • CUTTER SHARPENING MACHINES



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ROUND PIN BALL BEARING

To cut repairs—to reduce downtime—to increase production—use Lempco Anti-Friction Die Sets.

These are the only sets equipped with ball or roller bearing guide pins which makes it easy to set up dies by hand without the use of hammers, mauls, jacks or pry bars. This eliminates expensive accidents to dies and punches—saves up to 60% of mechanics' time and permits fast press speeds.

All bearings made with .0015" pre-load to eliminate "play" between the pin and bushing. Over 18,000,000 strokes in actual production failed to destroy pre-load and proved that this feature guarantees long die life —assures greater production between sharpenings.

For complete details on the revolutionary Lempco Precision Anti-Friction Die Sets, write for catalog.

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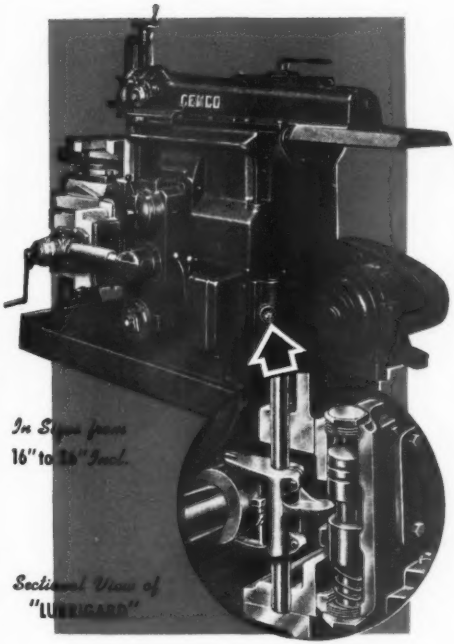
"Sorry, but we won't meet delivery, because our shaper burned out a bearing, and it will take a week to make repairs..."

NO NEED TO WATCH OIL GAUGE!
NO DANGER OF PRODUCTION DELAYS!

with "LUBRIGARD" Safety Device of GEMCO

Multi-Purpose SHAPERS



In Sizes from 16" to 26" Incl.

Sectional View of "LUBRIGARD"

Oil under pressure forces piston down, permitting projection on clutch control lever shaft to clear recess in piston, thereby allowing control lever to move into starting position.

The function of "LUBRIGARD" is to automatically prevent the ram of the shaper from being started: (1) In case oil supply in reservoir is insufficient; (2) Should pressure in the system be below the minimum required; (3) Should a leak or failure of the oil pressure system occur; (4) Should the filter become clogged; (5) Should the drive pulley rotation be incorrect.

In addition, "LUBRIGARD" will prevent the clutch control lever from being engaged while the drive pulley is at rest. Therefore, should the motor be started, the ram will not move unexpectedly. This prevents injury to the operator, or damage to the machine or work piece.

"LUBRIGARD" assures long, satisfactory shaper performance, because of adequate, automatically-controlled lubrication of all bearing surfaces. It increases the Precision Life!

Write Today for Bulletin GC-12D

GENERAL ENGINEERING & MFG. CO., ST. LOUIS 4, MO.

MANUFACTURERS OF PRECISION MACHINERY SINCE 1917

Where 500 pieces per grind is really *Something*

A FIRTHITE application

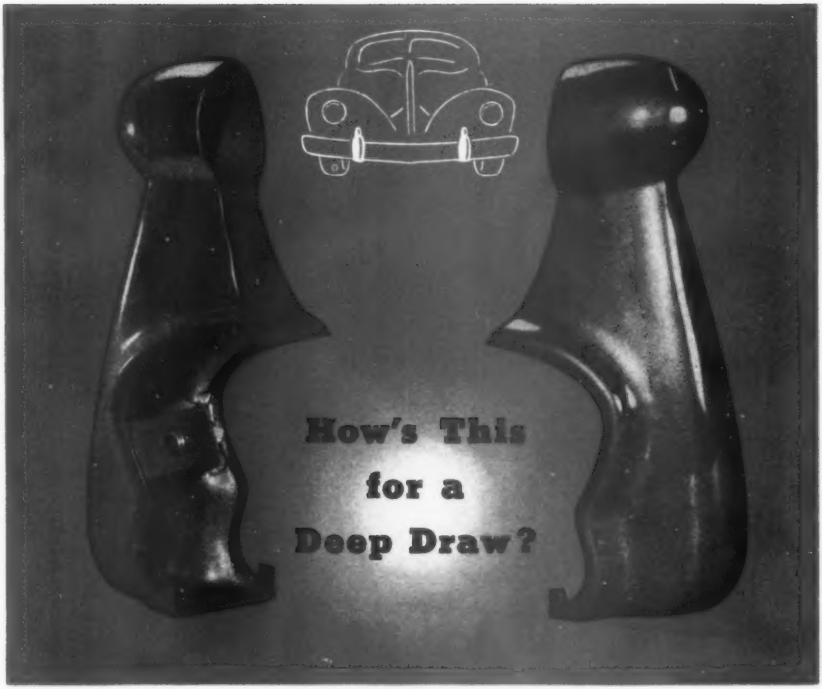
Conditions:
Depth of cut - - 3 32"
Feed per revolution - 0.016
Cutting speed - 250 feet per minute.

Turning, facing and chamfering a cast iron sleeve with Firthite sintered carbide tools on this job just meant about five times as many pieces per grind. Better production, less downtime, uniformly better products and a big reduction in grinding costs were the results.

If you have a cutting problem:

Call **Firth-Sterling STEEL COMPANY**

McKEESPORT, PA. • PITTSBURGH • NEW YORK • DAYTON • DETROIT
HARTFORD • PHILADELPHIA • CLEVELAND • CHICAGO • LOS ANGELES



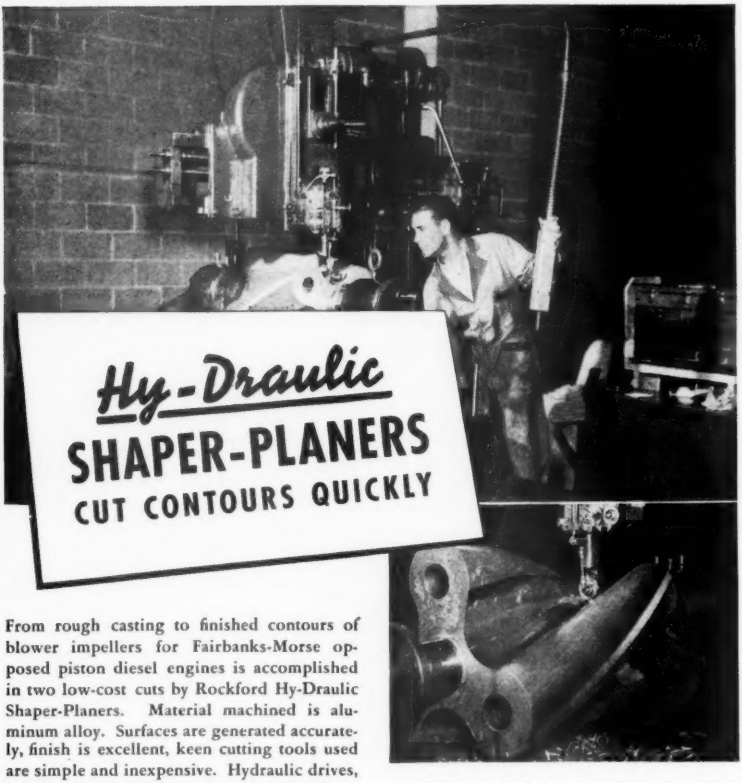
The job of making dies which would draw these "Bumperettes," required by a leading automotive manufacturer, was turned down by many tool and die makers. Because of intricacy of design, it seemed impossible to deep draw such a difficult part from .093 inch stock without welding. But the Hancock Tool and Die Company of Detroit, Michigan, licked the job. They did it by making the dies of Timken Graph-Mo Steel.

Graph-Mo is made exclusively in the flexible specialty mills of The Timken Roller Bearing Company. It is produced by precipitating minute particles of free graphite from the excess carbides in the grain structure of special carbon-saturated tool steels to form tiny lubricant receptacles.

Because of its exceptional non-seizing and free machining qualities, its high resistance to wear, and excellent heat treating properties Timken Graph-Mo Steel is revolutionizing the manufacture and use of many types of tools and dies. Write Steel and Tube Division, The Timken Roller Bearing Company, Canton 6, Ohio, for the eighth printing of 48 page booklet, titled "Timken Graphitic Steel."

TIMKEN
Fine Alloy
STEEL AND
SEAMLESS TUBES

★ YEARS AHEAD — THROUGH EXPERIENCE AND RESEARCH



Hy-Draulic SHAPER-PLANERS CUT CONTOURS QUICKLY

From rough casting to finished contours of blower impellers for Fairbanks-Morse opposed piston diesel engines is accomplished in two low-cost cuts by Rockford Hy-Draulic Shaper-Planers. Material machined is aluminum alloy. Surfaces are generated accurately, finish is excellent, keen cutting tools used are simple and inexpensive. Hydraulic drives, low inertia of reversing parts, cushioned reversals, quick return and easy operation of Hy-Draulic Shaper-Planers all contribute to high production of these contours at low cost. Eight similar machines in a row, some of them operated by women, maintained high output steadily through 2 and 3-shift operation. When temporarily ahead of the casting supply, several of these machines have been reverted to standard and used on high-priority tool work. On "shapes" and "straight" work, mass-production and "jobbing", Rockford Hy-Draulic Shaper-Planers are popular with operators, profitable for management. Write for details. Please address Department 2518

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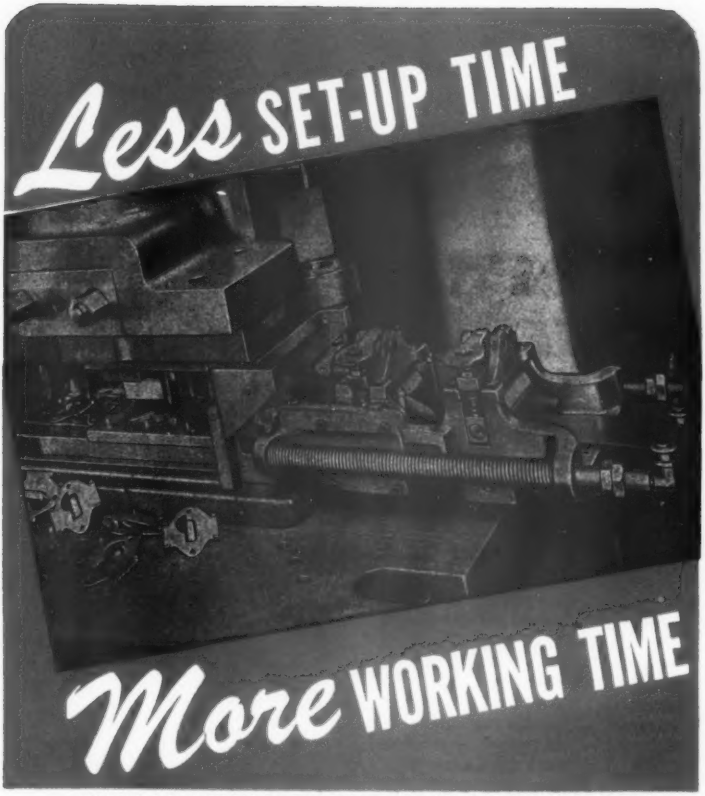
ROCKFORD MACHINE TOOL CO., ROCKFORD, ILLINOIS



. . . FOR YOUR PUNCH PRESS WITH THESE DICKERMAN FEEDS

These accurate, automatic feeds require no connection with the power shaft of your punch press. They save labor time and material waste, both for day-in-and-day-out production and on short runs.

The Dickerman Hitch Feed

1. Feeds from any position on any style die.
2. Saves time on both long and short runs.
3. Offers positive feed control, adjustable from 0" to its limit.

Made in two sizes, 2" and 4" Feeds
Send for booklet

The Dickerman Die Feed

1. Handles coiled stock up to ⅛" thick, widths up to 4".
2. Adjustable from 0" to its maximum feed length in increments of .001".
3. Fasten three screws — and it's mounted on your die set.

Write for booklet

H. E. Dickerman Mfg. Co.

321 TO ALBANY STREET SPRINGFIELD, MASS.

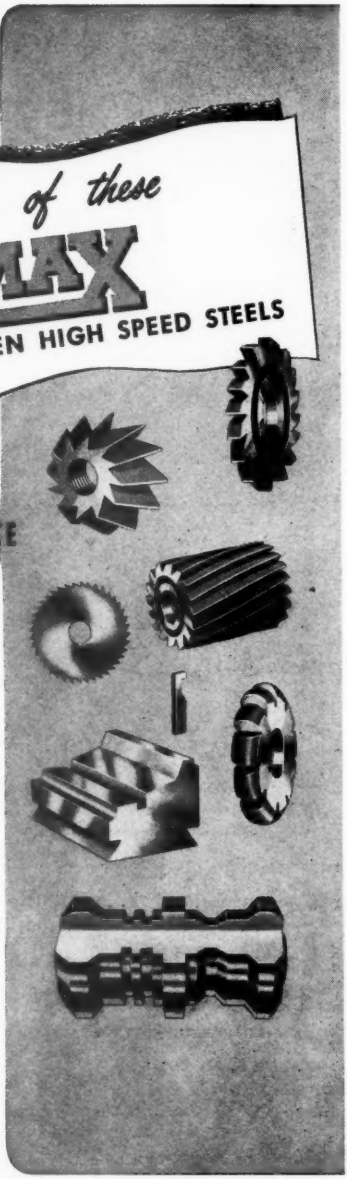
Specify one of these

MO-MAX

MOLYBDENUM—TUNGSTEN HIGH SPEED STEELS

for

BETTER TOOL PERFORMANCE



"LMW"	ALLEGHENY LUDLUM STEEL CORP.
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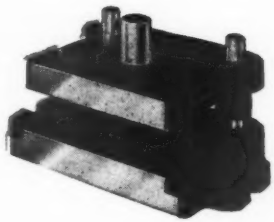

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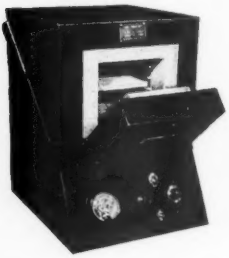
- Exterior size— 15" x 15" x 17"
- Operation— 110 V.A.C. only
- Rating—1.2 K.W.
- Ship. Wt.— Approx. 85 lbs.



$188.00

- Interior size—Model 7053 8" x 8" x 10"
- Exterior size— 18" x 20" x 24"
- Operation—110 V.A.C. or 220 V.A.C.
- Rating—3 K.W.
- Ship. Wt.— Approx. 225 lbs.

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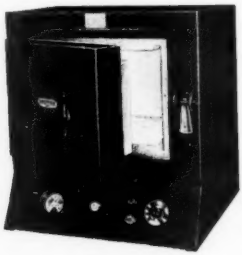
- Interior size—Model 7052 12" x 12" x 10"
- Exterior size— 22" x 22" x 24"
- Operation—220 V.A.C.
- Rating—4.8 K.W.
- Ship. Wt.— Approx. 350 lbs.



Lafayette Tool & Supply Co., 128 Lafayette St., New York 13, N. Y.
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Four operations were required to machine the tool hole in the boring bar shown above. They included counterboring, drilling, reaming and milling. To determine what mill would maintain the specified accuracies and complete the job in the least amount of time, test runs were made on a number of units.

Of the mills included in the test, a Gorton 8½-D Vertical Mill was selected as the machine to perform the operation because it proved the most highly efficient from every point-of-view . . . accuracy, speed, finish, ease of operation.

In this manufacturer's own words, the factors responsible for the superiority of the Gorton are "The Gorton is more solidly and accurately built than competitive machines designed for similar work."

HOW TO PRE-DETERMINE GORTON PERFORMANCE ON YOUR WORK

Gorton Super-Speed Millers are available in several models for a wide range of milling work. It is highly possible that the right model can produce equally outstanding results on jobs now being run in your plant. You can pre-determine Gorton results for yourself by using Gorton Engineering Service. Mail detail prints or work sample to Gorton at the address below. Tooling information and production estimates will be furnished promptly—no charge or obligation.

FREE For details on Gorton Super-Speed Vertical Mills as well as Duplicators and Pantographs, write today for Bulletin No. 1655.

JOB FACTS

NAME OF PART—Boring Bar with Micrometer Adjustment.

MATERIAL—Alloy Steel.

MACHINE—Gorton Vertical Milling Machine Model 8½-D.

FEED—Hand.

OPERATIONS—

1. Counterbore—$1\frac{1}{16}$"; 900 r.p.m.
2. Drill—$\frac{23}{64}$"; 1350 r.p.m.
3. Ream Drilled Hole—.369" and .375"; +.0005", −.0000"; 1350 r.p.m.
4. Milling Eccentric Groove $\frac{3}{8}$" dia. x $\frac{2}{32}$"; +.0000", −.0005"; offset: .093"

TIME—15 minutes, floor-to-floor time.

REMARKS—Completed on a production basis with high accuracy and finish.

GEORGE GORTON MACHINE CO.

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McKINNEY
CLEVELAND

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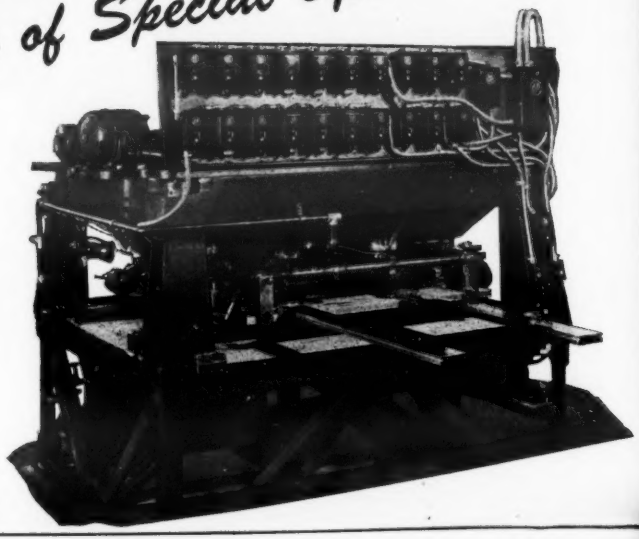
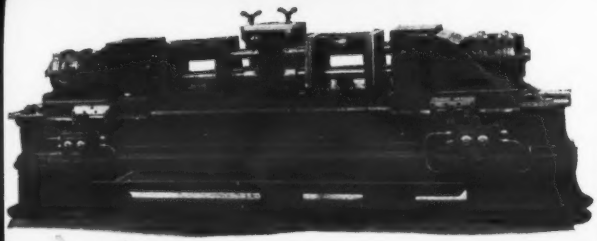
TOOL BUILDING SKILL AND EXPERIENCE
Also Serve in Developing Machines for
Fast Handling of Special Operations

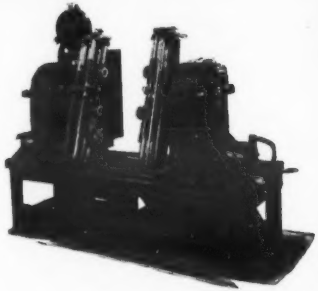
Machine with knives and wire wheels which remove rubber flash as tank treads move along on conveyor.





(Above) Machine which performs 22 milling operations simultaneously on Boford gun platforms. Each spindle has overload protection.

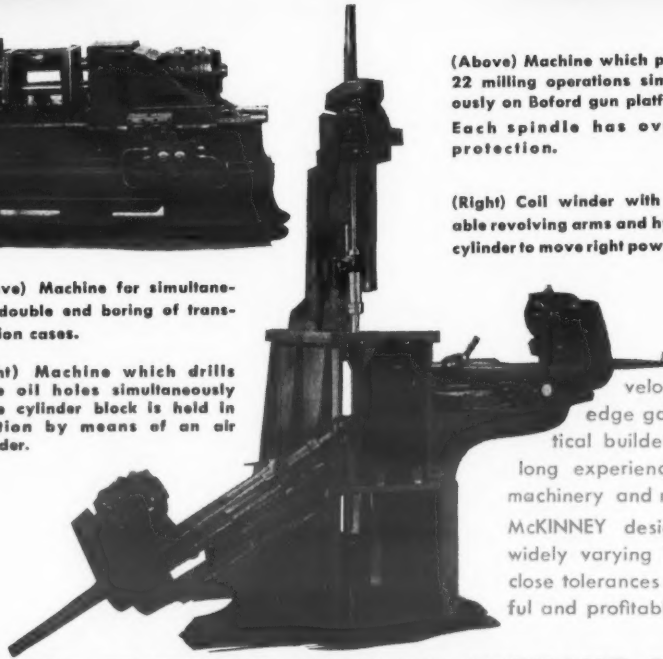
(Right) Coil winder with adjustable revolving arms and hydraulic cylinder to move right power head.



(Above) Machine for simultaneous double end boring of transmission cases.

(Right) Machine which drills three oil holes simultaneously while cylinder block is held in position by means of an air cylinder.

Electric butt welder adapted to handling a range of sizes by merely changing vises.



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McKINNEY designed machines deliver products of widely varying kind in great volume — machined to close tolerances and at low cost that assures successful and profitable competition.

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1. **Is the machine the right type for your job? Is it big enough? Is it too big?**
2. Has the machine been abused? (Even Colonials won't stand too much of that.) If so, how much will it cost to recondition it? (Check this with Colonial—we'll be glad to help.)
3. **Don't take anybody's word for the machine. Have a competent broaching engineer take a look at it. (Our field engineers will be glad to advise you.)**
4. If it needs any rebuilding, tooling or fixtures, send it to Colonial. We will be glad to help, for we are proud of our machines in service.
5. **Be sure the total cost to you won't be more than the cost of a new machine. (Get a quotation on a new one to compare.)**
6. If you are planning on buying a used Colonial get a set of bulletins on Colonial machines. We'll be glad to furnish them, and tell you which type and size is best suited to your job.

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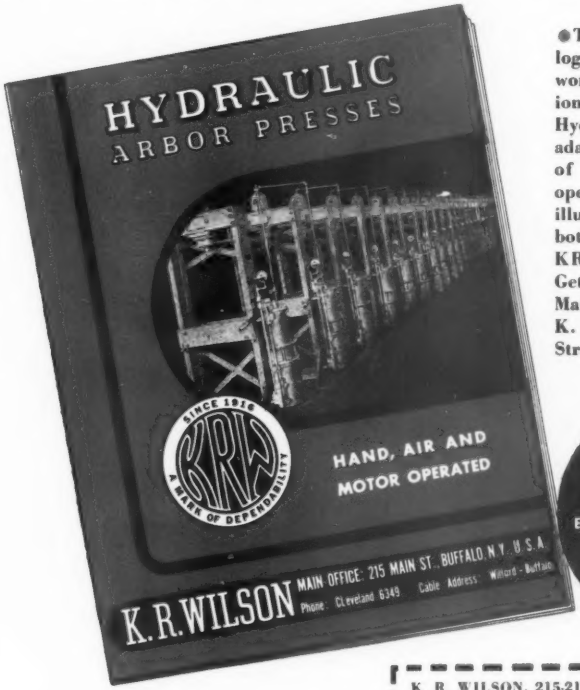

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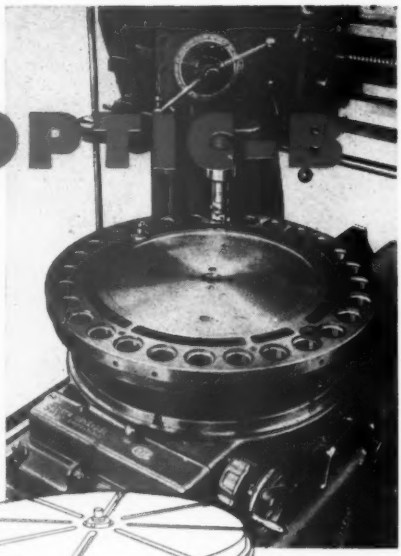
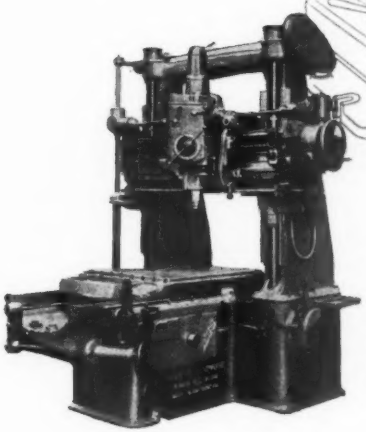
28 PRECISION HOLES
WITHIN 1 SEC. OF ARC ON THE

SIP HYDROPTIC-B

-no preliminary laying out! -no jigs or fixtures!



All 28 holes on the part shown at the right were bored at one setting on the SIP Hydroptic-B . . . without jigs and without preliminary laying out! The unique optical setting feature of the SIP Hydroptic-B Jig Boring and Milling Machine permits laying out in rectangular coordinates to within 0.0002" limits of accuracy of setting of table and spindle. And, with the circular dividing table, work dimensioned in polar coordinates can be located accurately to within ONE SECOND OF ARC!



With the SIP Hydroptic-B Jig Boring and Milling Machine, work can be located, drilled, bored or milled without preliminary laying-out. More than a Jig Boring machine, the Hydroptic-B is used profitably for direct production work where highest standards of accuracy must be maintained. More than a Jig Boring machine, the Hydroptic-B is also a measuring instrument of unquestioned accuracy, and as such it can be used dependably to check its own work. Its automatic hydraulic table feeds and its wide range of spindle speeds make highest precision operations possible at production speeds. The construction of the Hydroptic-B assures the maintenance of superlative accuracy, even under heavy table loads. In addition, the optical measuring system, consisting of high precision standard scales read through protected microscopes, is free from wear and mechanical stress. Write for further details of the SIP Hydroptic-B and other SIP Jig Boring and Milling Machines.

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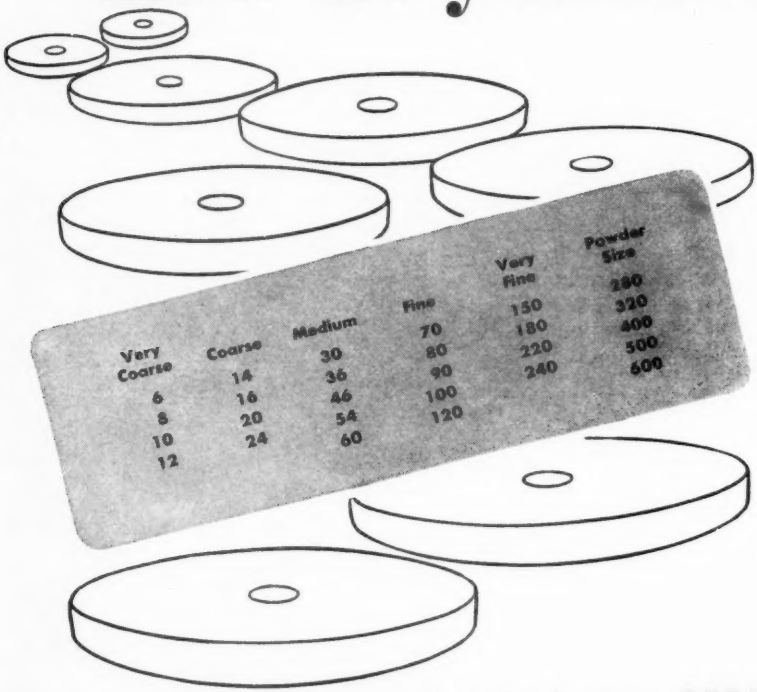

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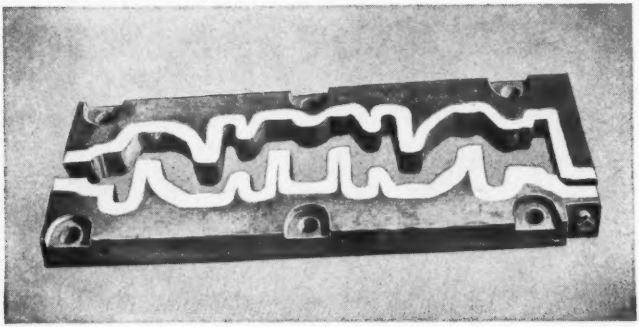

This crankshaft trimming die is hard-faced at points of wear with HAYNES STELLITE No. 6 rod. It trimmed from 150,000 to 155,000 pieces before it was returned to the die shop for touching up. Before the practice of hard-facing these trimming dies was adopted, they produced less than 500 pieces before it was necessary to refit them.

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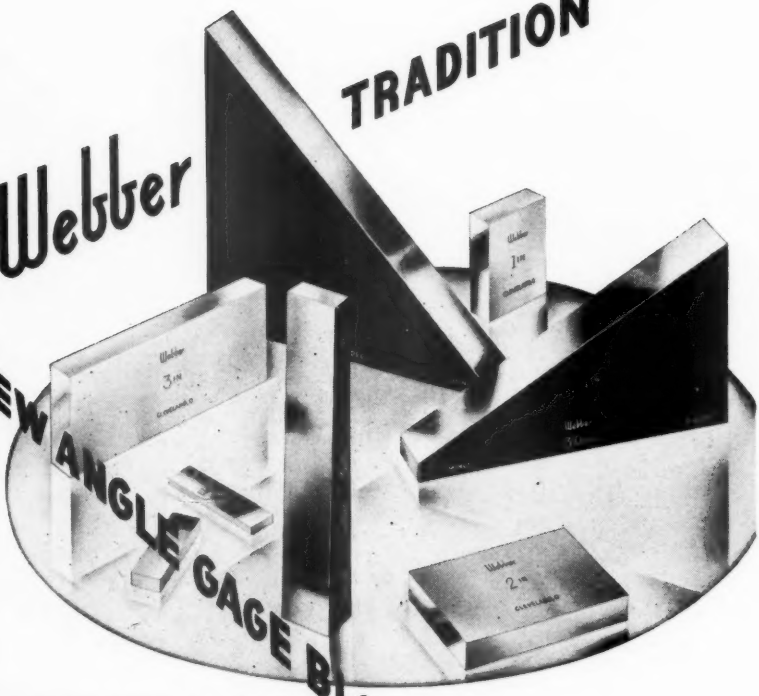


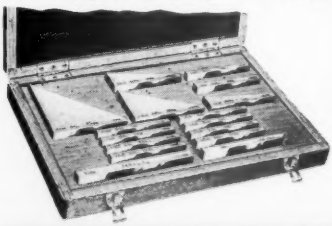
NEW ANGLE GAGE BLOCKS

The New WEBBER ANGLE GAGE BLOCKS, in the tradition of WEBBER precision craftsmanship, make angle measurement a simple, fast and sure operation. Accurate to within one five-millionth part of a circle. Furnished individually or in 3 sets:

Set No. 14-A: 0 to 103 degrees in 1 second steps — total of 370,800 angles $450.00

Set No. 10-A: 0 to 103 degrees in 1 minute steps — total of 6,180 angles $350.00

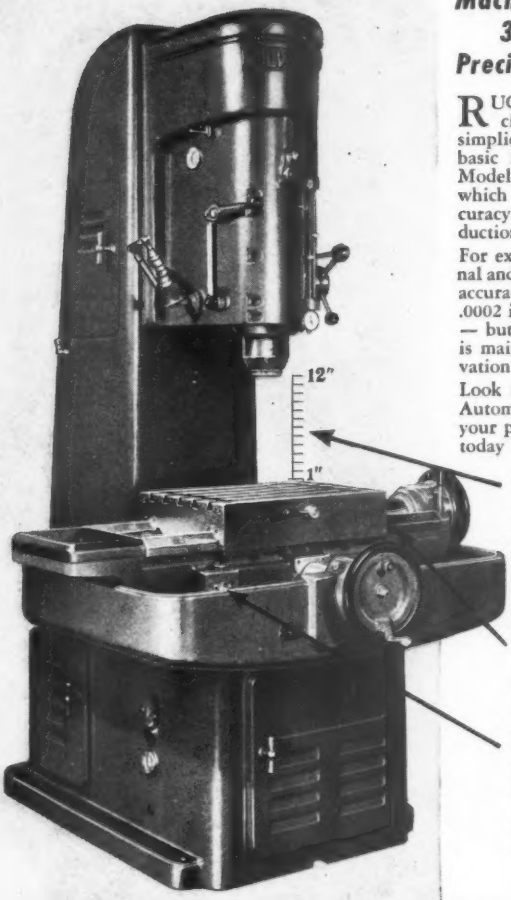
Set No. 6-A: 0 to 103 degrees in 1 degree steps — total of 103 angles $235.00



Webber
GAGE COMPANY
12903 Triskett Road • Cleveland 11, Ohio

When You Do Precision Boring You Can Depend On

THREE DIMENSIONAL ACCURACY!



Positive Alignment of Kearney and Trecker's Autometric Boring Machine Gives You Unerring 3-Way Accuracy for all Precision Boring Operations!

RUGGED CONSTRUCTION . . . precision engineering and design . . . simplicity of operation — these are the basic features of Kearney & Trecker's Model C Autometric Boring Machine which give you positive unsurpassed accuracy for toolroom, laboratory or production precision boring operations!

For example, not only are the longitudinal and transverse movements of the table accurate within a maximum tolerance .0002 inch in any 12 inch at the table top — but this same high degree of accuracy is maintained at all levels up to an elevation 12 inch *above the table top!*

Look to Kearney & Trecker's Model C Autometric for the modern answer to your precision boring problems — write today for catalog No. CMA10.

1. VERTICAL ACCURACY

Base, column and guard cast in one piece to form a solid, rigid foundation and backbone for the entire machine, assure precise alignment at all times. Longitudinal and transverse movements of the table are accurate within a minimum tolerance of .0002 inch in any 12 inches of length at all levels up to 12 inches *above the table top.*

2. LONGITUDINAL ACCURACY

Table is mounted on accurately ground ways and positioned by a precision screw which assures longitudinal accuracy at all work elevations above the table.

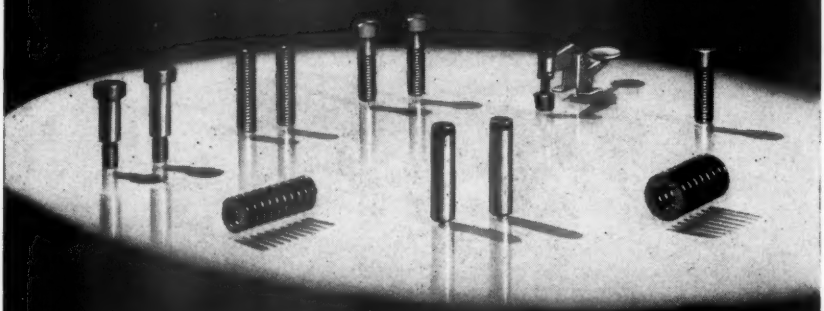
3. TRANSVERSE ACCURACY

Saddle is also mounted on accurately ground ways and positioned by a precision screw thus maintaining transverse accuracy at all work elevations. All alignments affecting accuracy of the workpiece are held to within a non-accumulative error of .0002 inch in any 12 inches.

KEARNEY & TRECKER PRODUCTS CORPORATION

MILWAUKEE 14, WISCONSIN

Use "Detroit" Accessories for Dependability



These assembly items are known throughout industry for their quality and precision.
For quick service draw on our large stock of Dowel Pins (163 Standard sizes plus oversizes), Springs, Socket Head Cap Screws, Stripper Bolts, Set Screws and Toggle Clamps.
Standard and Special Die Sets in all sizes.

CALL "DETROIT"

DETROIT	TR 2-5150
INDIANAPOLIS	LI 3884
MINNEAPOLIS	AT 5264
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SEATTLE	SE 2090
PORTLAND, ORE.	AT 1466
SAN FRANCISCO	MA 8532
BUFFALO	PA 9206
PHILADELPHIA	VIC 4084
ROCK ISLAND, ILL.	RI 743

DETROIT DIE SET CORPORATION

2895 W. GRAND BLVD. • DETROIT 2, MICH.

DETROIT DIE SETS ★

SPEED-WET *and* RESINIZED

TWO *NEW* METALITE DISCS

Announcing—for immediate release—two new RESIN-TYPE Metalite Fibre Discs—developed under war-time research for accelerated peace-time production.

SPEED-WET METALITE—green backing—extra heavy duty with extreme flexibility.

RESINIZED METALITE—brown backing—heavy duty, all purpose.

Combining the heat and humidity resistance of the Behr-Manning Durabonded process with the extra toughness and stamina of the resin treatment, Speed-wet and Resinized Metalite Fibre Discs are truly masterpieces of research in postwar disc manufacture. Production improvement, demonstrated in extensive field tests against first grade discs, averages 50 to 100%.

For increased production yield, you are urged to test these new discs on all portable disc grinding jobs at once. Instruct your distributor to include a test quantity of Speed-wet and Resinized Metalite Fibre Discs with your next order.

BEHR-MANNING • TROY, N.Y.

MANUFACTURERS OF QUALITY COATED ABRASIVES SINCE 1872

"HARDSTEEL"

DESTRUCTIVE TOOL BIT TEST

HARDSTEEL *vs.* Cast Alloy Cutting Tools

TEST LOG

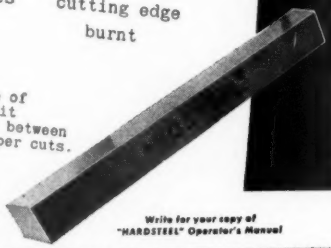
Material: Hardened and drawn High Manganese, High Carbon tool steel.
Tensile Strength: 176,000 lbs. per square inch
Rockwell Hardness. C-38 Average
Depth of Cut. .100"
Feed Per Revolution: .0035"
Surface Feet Per Minute: 130

RESULTS

	Average Total Time to Failure	Tool End Wear
"Hardsteel"	20 minutes	None
Competitor "A"	11 minutes	.008"
Competitor "B"	10 minutes	.007"
Competitor "C"	8 minutes	cutting edge burnt

Conclusion:

The inherent heat resistance of "HARDSTEEL" tool bits makes it possible to hold size longer between grinds, and take faster, deeper cuts.



Write for your copy of "HARDSTEEL" Operator's Manual

BLACK DRILL CO. Division of Black Industries
1368 East 222nd Street • Cleveland 17, Ohio

"HARDSTEEL"

DRILLS • TOOL BITS • SPECIALS

OTHER DIVISIONS OF BLACK INDUSTRIES:
BLACK BORING AND MACHINE CO. • MEC-RAD DIVISION

Assembles 3000 HUBS & ECCENTRIC GEARS per Hour!

SPEED PLUS ACCURACY was the important consideration required of the eccentric gear hub assembly machine.

The result was this Barth-designed-and-built machine which assembles the hub in the eccentric gear at a rate of 3000 per hour!

The hubs of the gears are hopper fed while the gear blanks are hand fed over spring pins on the index rotor. A plunger mechanically inserts the hub in the precise location and to the depth required . . . the completed assembly is ejected into a container at the base of the machine.

One air cylinder . . . at forty pounds pressure . . . operates both the index and plunger mechanism.

If you have a production problem involving designing, engineering and production of special machinery, tools, dies, fixtures, etc., the Barth organization is ready to help you increase production, reduce costs and improve products. Simply write or telephone . . .

DESIGNERS · MANUFACTURERS
DIES · TOOLS · GAUGES · JIGS
SPECIAL MACHINERY

BARTH

STAMPING & MACHINE WORKS

DENISON AT 34TH STREET · CLEVELAND 9, OHIO

Photograph courtesy Black & Decker Mfg. Co.

HERE *you need an*

ARMOURCLAD FIBRE COMBINATION DISC!

Armour Abrasives Help You Do Your Jobs Better

For better, faster finishing you'll need the fastest tools and the best abrasives possible.

In any operation . . . in cutting welds . . . in removing burrs . . . in leveling metal surfaces . . . there are *specialized* ARMOUR ABRASIVES *designed to do a better job at less cost.* The faster, sharper, cooler-cutting *Armourclad Fibre Combination Disc* is only one of Armour's *complete* line of better metal-working abrasives.

It will pay you to call on Armour's experienced technicians. They will gladly help you choose the abrasives and methods which do your jobs best.

ARMOUR *Sandpaper* WORKS

DIVISION OF ARMOUR AND COMPANY

1355 West 31st Street • Chicago 9, Illinois

Engineered Hole Location Service

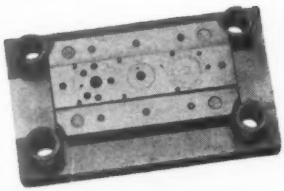
Prolongs Die Life

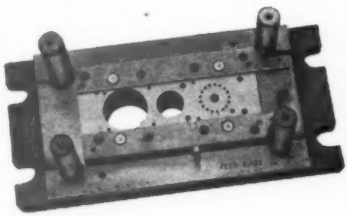
Electrical lamination stampings are tough on dies. With thin abrasive stock to be cut in enormous quantities, absolute uniformity in the small punch and die clearances is a "must."

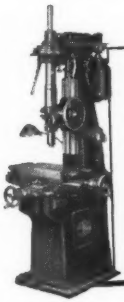
Here's how the Moore Jig Borer and Moore Jig Grinder team up to pay dividends in the toolroom and assure 25% to 100% added die life:

Both machines work to pre-engineered dimensions, enable all parts of the die to be made *to figures instead of to "fit."* Coordinate calculations, set up in the engineering department, can be used throughout in boring the soft pieces in the Moore Jig Borer and finish-grinding the hardened parts in the Moore Jig Grinder. And all parts of the die can be made concurrently by several toolmakers on an *interchangeable parts-and-assembly basis* instead of progressively as a one-man job.

Study the table below and consider how this Engineered Hole Location Service built around the Moore Jig Borer and Moore Jig Grinder can lower your tool costs...increase the capacity of the toolroom...speed new dies to your pressroom. Then ask a Moore sales engineer to stop by and answer your questions in detail.

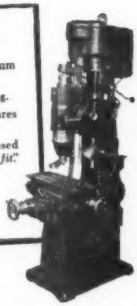






HOW MOORE JIG BORER AND MOORE JIG GRINDER PROMOTE INTERCHANGEABILITY IN THE TOOLROOM

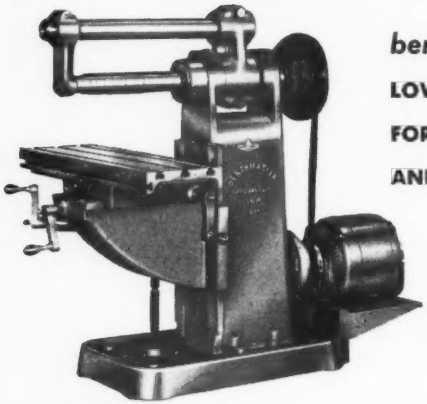
1. ***Moore Jig Borer spots, drills, bores or reams all*** holes with minimum tool changes.
2. ***Moore Jig Grinder relocates holes*** in hardened parts by finish-grinding.
3. ***Accurate Lead Screw Measuring Principle*** in both machines assures precise, rapid table settings within .0001" by coordinate location.
4. ***Coordinate calculations made by engineering department*** are used throughout in boring and finish-grinding *to figures instead of to "fit."*
5. ***Soft and hardened parts are made concurrently***, not progressively. Errors in hardened parts are corrected, not retained and transferred to other parts.
6. ***Both machines inspect own work*** without disturbing set-up.



MOORE JIG BORER (MOORE TOOLS) **MOORE JIG GRINDER**

MOORE SPECIAL TOOL COMPANY, INC. • 726 UNION AVENUE, BRIDGEPORT 7, CONN.

ONE for TWO jobs



benchmaster **OFFERS A LOW-PRICED BENCH MACHINE FOR *BOTH* HORIZONTAL AND VERTICAL MILLING**

benchmaster mill with horizontal spindle overarm

SAVES VALUABLE SPACE—CUTS DOWN EQUIPMENT COSTS

Now you can obtain a precision perfect, high-speed *benchmaster* milling machine that's easily convertible from a horizontal to a vertical miller by simply interchanging spindle attachments. Its *un*usual versatility, plus the *usual* quality-plus *benchmaster* workmanship, make this double-duty milling machine an outstanding addition to your shop.

SPECIFICATIONS: Table size—6" x 14"—Three Tee Slots ⅜", 2" center Longitudinal travel 8½"—Traverse travel 5½"—Vertical travel 8½" on vertical mill—9½" horizontal mill—Height 28"—Weight (less motor) 215 lbs.—Requires ⅓ h.p. motor—Spindle speeds (standard 1725 rpm motor) 450-850-1400-2100 rpm.

benchmaster MANUFACTURING COMPANY
2952 WEST PICO BOULEVARD
LOS ANGELES 6, CALIFORNIA

More Speed...
LONGER DRILL LIFE with CONTINENTAL'S *New* DRILL CHIP BREAKER

Faster drilling action and prolonged tool life are but two of many advantages obtained with the Continental Drill Chip Breaker. By breaking chips into small, uniform pieces that are easily carried up the flutes of the drill, clogging is eliminated. The unit can be used vertically, horizontally, or at any angle as long as the housing can be kept stationary while the drill rotates. The arm prevents rotation of the housing. Where space permits, the Continental Drill Chip Breaker can be used in multiple spindle heads. ***Write for Continental Bulletin 28161 for sizes, complete specifications and 7 ways to profit by this new Continental product.***

CONTINENTAL TOOL WORKS
CTW
EX-CELL-O CORPORATION

With the Continental Drill Chip Breaker, the chip is broken at regular intervals. Small loose chips are easily carried up the flutes. Holes are straighter, rounder, and have better wall finish.

46—51

CONTINENTAL TOOL WORKS
DIVISION OF EX-CELL-O CORPORATION
1200 OAKMAN BOULEVARD • DETROIT 6, MICHIGAN

NOW AVAILABLE

FOR IMMEDIATE DELIVERY

THE *New*

CLEVELAND INDEX HEAD

Regrind
YOUR TOOLS
IN EXACT
CONCENTRICITY
ON ANY
SURFACE GRINDER

Designed to Hold All Straight or Taper Shank Tools from 1/16" to 1 1/2" Diameter

Write for Catalog and Complete Information

GRINDERS & FIXTURES Inc.

1261 WEST 4th STREET • CLEVELAND 13, OHIO

IN MILK... IT'S HOMOGENIZED

IN HIGH SPEED STEELS... IT'S **DESEGATIZED**

THE IMPROVEMENT IS *apparent at a glance*

* *These are unretouched photographs, slightly reduced, of 4" round bars of 18-4-1 type Latrobe Electrite No. 1 high speed steel. Discs hardened, polished and etched. The one at left produced by ordinary standard process, the one at right Latrobe's revolutionary DESEGATIZED process*

LATROBE

DESEGATIZED HIGH SPEED STEELS

YOUR COPY IS READY

Be sure to write for this booklet, describing Latrobe's new and exclusive tool steel development!

In Latrobe's DESEGATIZED High Speed Steel, the carbides are evenly distributed throughout the entire cross-section; more evenly than has ever before been possible. This revolutionary improvement is apparent in the photo shown at right. • DESEGATIZED High Speed Steel will do a better job because it is more uniform throughout. It responds more consistently to heat treatment and affords more even resistance to wear. Latrobe's exclusive new process serves to simplify your high speed steel problems.

Our nearest representative will be glad to discuss its application to your particular requirements.

Latrobe ELECTRIC STEEL COMPANY

MAIN OFFICES *and* PLANT •• LATROBE • PENNSYLVANIA

MODEL 3 CONTOUR GRINDER

FOR RAPID ECONOMICAL GRINDING

For hand grinding which other types of grinders won't readily handle, this Baker Model No. 3 Contour Grinder, of simple, rugged design, is a thoroughly practical, cost saving machine. It is especially adapted to use in tool and die shops and tool rooms.

Capacity: diameter of wheels ½" to 4"; face of wheels 2", 2½", 3"; diameter of table 18". Vertical reciprocating movement of spindle $\frac{3}{16}$".

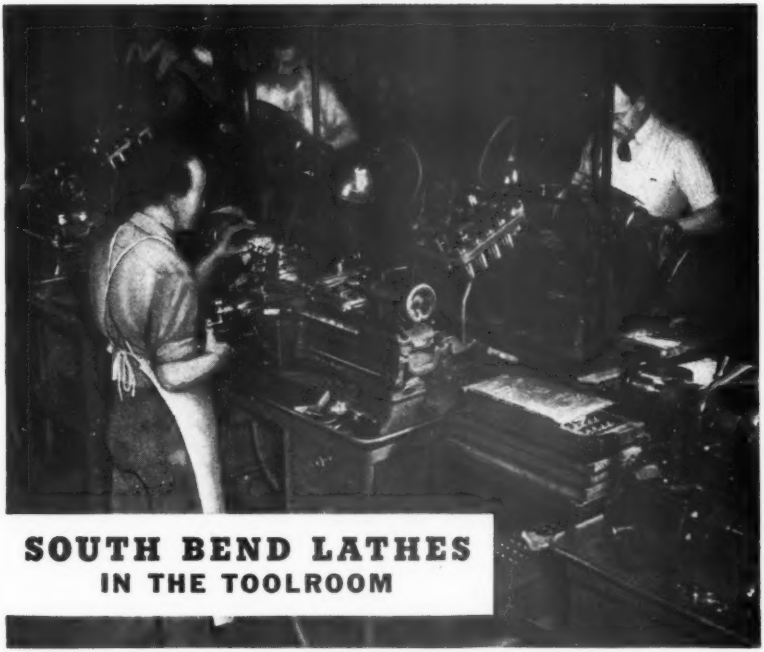
Reciprocating action results in better grinding and longer grinding wheel life because it prevents forming of shoulders on wheel.

Easy-to-mount diamond dresser is standard equipment.

BAKER BROS.

TOLEDO 10, OHIO

For complete details send for our folder.

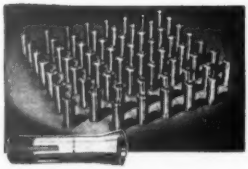


SOUTH BEND LATHES
IN THE TOOLROOM

WHERE PRECISION AND PERFORMANCE COUNT!

Nowhere in the plant are unfailing precision and dependable performance more important than in the toolroom. It is here—in the "tools that make the tools"—that the quality and cost of the product are largely pre-determined.

The ability of South Bend Lathes to perform a wide variety of precision operations makes them the most valuable and versatile tools in the toolroom. The ease and speed with which they can be changed from one set-up to another is a definite advantage and still another reason for their wide popularity. A complete line of attachments and accessories are available which will simplify your tooling still further. Write today for Catalog 100-D which illustrates in full color and completely describes the complete line of South Bend Engine Lathes, Toolroom Lathes, and Turret Lathes. Sent free, postpaid.



SOUTH BEND COLLETS

are available with capacities from 1/16-inch to 1-inch. Made in 1/64-inch steps. Write for Catalog 77 showing line of attachments.

SOUTH BEND LATHE WORKS

LATHE BUILDERS SINCE 1906

432 EAST MADISON STREET • SOUTH BEND 22, INDIANA

SET YOUR MACHINES LEVEL WITH Empco JACKS

Saves set up and re-leveling time

Self aligning on uneven floors

Accurate two-way adjustment

Machine Tool Manufacturers strongly emphasize the need, not only to set machines level, but to KEEP 'EM THAT WAY. Periodic re-leveling is essential for accurate work tolerances. How often, depends on the type of foundation. No method of machine setting is stable enough to maintain the accuracy of initial leveling. It is important to check after first month of operation, then check periodically and re-level whenever necessary.

When a machine is set on EMPCO JACKS the whole operation is the work of only a moment: Simply apply a wrench to the "hex" screw head, turn right to lift or left to lower until your level indicator reads "zero".

Write for descriptive folder. Prompt delivery.

SIZES AVAILABLE
No. 1...2 " normal height
No. 2...2⅜" normal height
No. 3...3¾" normal height

EMPCO

THE ENTERPRISE MACHINE PARTS CORPORATION
2735 JEROME AVE. DETROIT 12, MICH.

HEAT TREAT SMALL PARTS

In Your Own Plant

ESSENTIAL FOR TOOL AND DIE SHOPS

You save time and money heat treating small tools and dies in a Cooley Electric Furnace. Uniform temperatures are maintained throughout the furnace chamber to assure even heating of parts. The heating elements are embedded in refractory materials, protecting against atmospheric attack. They are easily replaceable.

ECONOMICAL TO OPERATE

To hold 1600° F. in the MH-3 furnace requires less than 2 kw. At power rate of 2c per kw.-hr., operating cost is under 4c per hour. The MH-4 furnace requires less than 2.5 kw. or under 5c per hour at the same rate. Cooley Furnaces are easily installed—ready for immediate service by connecting power lines to two terminals. Quiet in operation—no fumes or odors—no ventilating necessary—they can be located at any convenient place in the shop.

More Profitable Reasons for Using Cooley Furnaces

1—Hardening, drawing and tempering small batches in large furnaces is uneconomical.

2—Small parts can be normalized and annealed quickly and easily.

3—Convenient for pre-heating prior to high-speed hardening.

4—Always available to handle emergency repair work without delay.

5—Use as a pilot furnace to predetermine techniques for production heat treating.

TWO NEW OPTIONAL FEATURES AVAILABLE

1. Vertical Lift Door — Counter weighted for ease of operation—conserves heat where door need not be fully opened to enter or remove work. Supplied in place of standard hinged hearth door at $20.00 additional to regular furnace prices shown below.

2. Heavy Gauge Steel Stand — For ease of installation and operation—locates furnace at most convenient operating height and provides additional working and storage space. Add $35.00 to regular furnace prices shown below.

AVAILABLE IN TWO SIZES

Type	Chamber Capacity	Amps 115 V	Watts	Amps 230 V	Price
MH-3	8″W 6″H 14″L	29.6	3400	14.8	$146.00*
MH-4	10″W 6″H 18″L	.....	4800	20.9	$222.50*

*Includes Hearth Plate

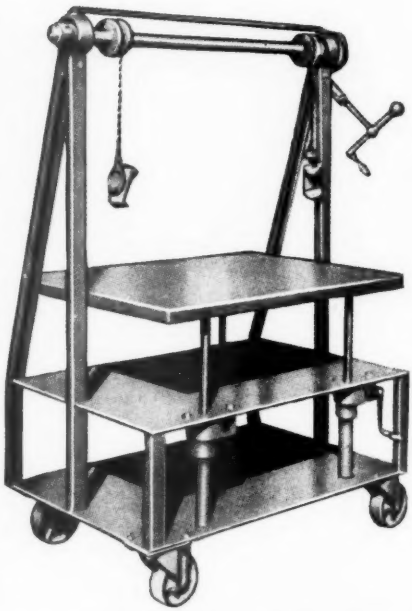
MAX. SAFE TEMPERATURE — Continuous operation, 1750° F.; Intermittent operation, 1850° F.
AUTOMATIC CONTROL—Indicating Controlling Pyrometer—Thermo-couple and lead wire—approximately $150.00.

NO SALESMEN WILL CALL

Ask for free information and ordering instructions so you can make your own decision and determine your own requirements. Write for Bulletin No. 50 today—no obligation.

COOLEY ELECTRIC MANUFACTURING CORP.
32 South Shelby Street Indianapolis 7, Indiana
Export Department, 1111 S. Ferry Building, New York 4, New York

ONE MAN HANDLES DIES UP TO 3000 LBS!



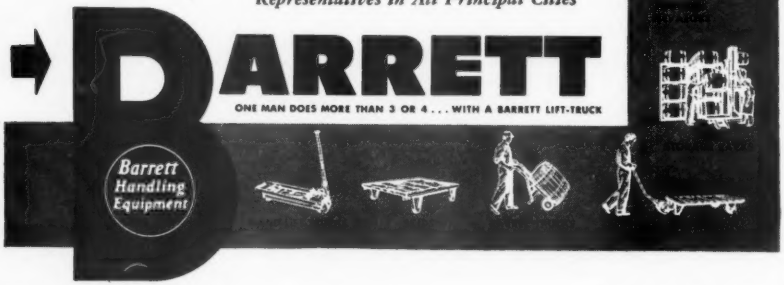
With the new BARRETT MULTI-DUTY DIE TABLE, one man does everything! Here's a lifting table, work bench, die separator, and floor truck—all in one—designed to save time and energy; cut costs in storing, moving and setting up dies. Note these outstanding advantages:

1. Makes die separation and assembly a simple, one-man job.
2. Handy crank-operated hoist does the heavy lifting.
3. Table is adjustable to height from 24″ to 40″ above floor.
4. All gears are accurately machined and fully enclosed.
5. Husky all-steel construction; electric welded, rigid.
6. Easy to operate; no complicated parts to give trouble.
7. Rolls easily on heavy-duty ball bearing casters.

Offered in two sizes with 44″ x 28″ and 36″ x 24″ tables; safe load capacities from 2,000 to 3,000 pounds. Write today for descriptive bulletins.

BARRETT-CRAVENS CO., 3269 W. 30th St., Chicago

Representatives in All Principal Cities



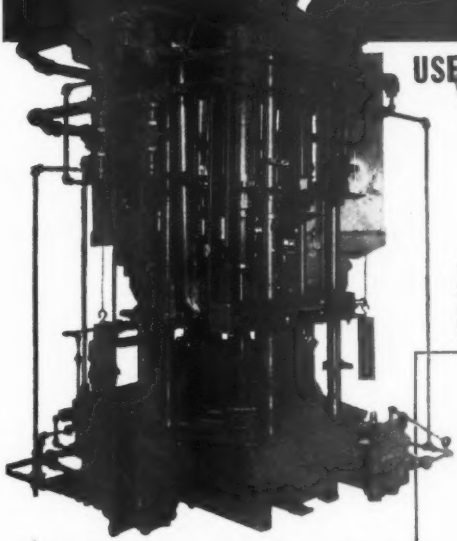
NOW IT CAN BE TOLD

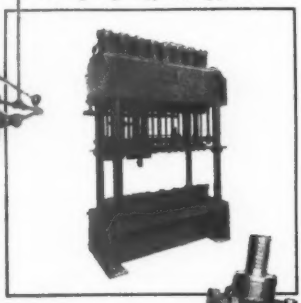
Shell-loading Machines—

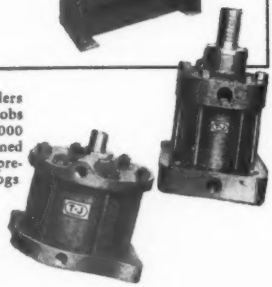
USE T-J

CYLINDERS

T-J Hydraulic Cylinders on these machines press different ingredients into shells at very accurate pressures. At left, rotary type press—which also employs small cylinder (shown on front) for indexing. Below, "straight eight" type loading press.







Among the wide range of war production jobs performed by T-J Cylinders is this application on shell-loading machines manufactured by Proctor & Schwartz, Inc., Philadelphia. The machines are hydraulically operated and *entirely automatic*—depending on the high efficiency and accuracy of T-J Cylinders!

Similarly—for hundreds of tough jobs of power movement in industry today—you'll find T-J Air and Hydraulic Cylinders a real time-saver, muscle-saver and money-saver! Ideal for jobs where pushing, pulling or lifting is needed . . . 100 lb. or 50,000 lb. Available in many standard sizes and styles . . . both cushioned and non-cushioned types. Backed by 29 years' experience . . . precision-built for unbeatable performance! Write for latest catalogs The Tomkins-Johnson Co., Jackson, Mich.

FOR TOUGH JOBS SPECIFY

TOMKINS-JOHNSON

T-J

AMMCO

7″ SHAPER

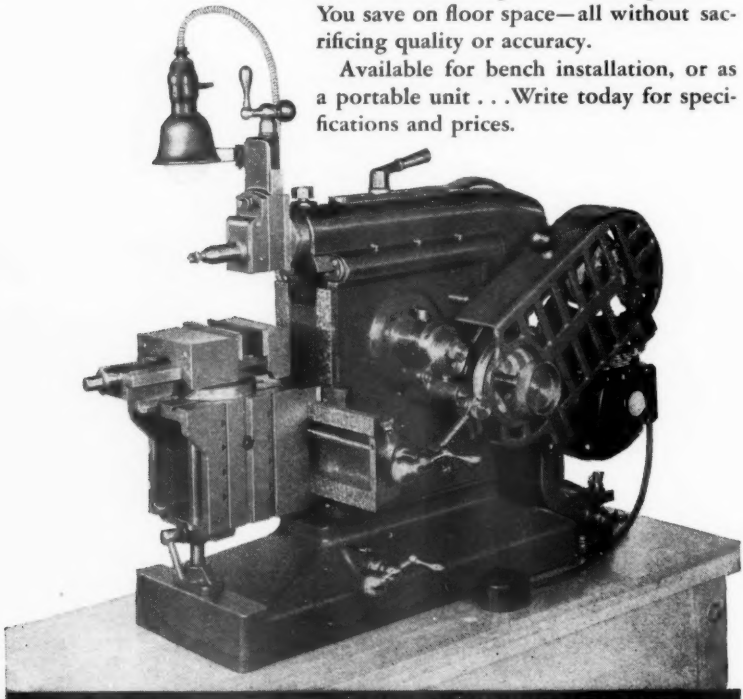
--A precision machine

meets postwar needs for accuracy, speed and economy

If your production costs are going up, and your profit margin is getting less and less (and whose isn't)—consider what the Ammco 7″ Shaper can do for you.

The accuracy of work turned out on an Ammco 7″ Shaper assures precision production unsurpassed by larger machines selling for hundreds of dollars more than the Ammco . . . In addition to low initial cost, you also effect big savings in time and expense on set-up operations . . . You save on electrical power consumption . . . You save on floor space—all without sacrificing quality or accuracy.

Available for bench installation, or as a portable unit . . . Write today for specifications and prices.



AMMCO 2100 COMMONWEALTH AVENUE NORTH CHICAGO, ILLINOIS

Now...Elgin *Sapphire* Tipt

MICROMETERS

2,000,000
PRODUCTION GAGINGS

The original Elgin Sapphire TiptMicrometer is in use without wear after more than 2,000,000 gagings in a drill plant.

READY FOR SHIPMENT NOW. 1" — $25, 2" — $26.50, 3" — $28. **Discount on quantities.** Elgin Sapphire Gages have been out-wearing steel as much as 7,000 to 1. Now Elgin Sapphirehasbeenmounted on the anvil and spindle of a superbly engineered lightweight micrometer. **SEE THE ELGIN MICROMETER**

FEATURES: Sapphire Tipt Anvil and Spindle • Adjustable Spindle Bushing • Hollow, Lightweight Frame of Stabilized Steel • Tool Steel Hardened-Ground Spindle Thread • Positive Lock Nut • 1/10 Thousandths Graduations (by precision graduating machine)

SAPPHIRE PRODUCTS DIVISION

Elgin National Watch Company, 932 Benton St., Aurora, Ill.

REPRESENTATIVES IN CITIES FROM COAST TO COAST

·ELGIN·
Sapphire Gages
DIMENSIONAL FIDELITY IN GAGING OPERATIONS

Added POWER to PUSH PULL LIFT or Lower

ANKER-HOLTH NON-ROTATING CYLINDERS AIR and HYDRAULIC

"AIRGRIP" Non-Rotating Cylinder mounted on tailstock of Sundstrand Lathe.

Note precision construction and ease of disassembling.

HI-POWER DOUBLE-ACTING NON-ROTATING CYLINDERS, either air or hydraulic, deliver fast, smooth, dependable power. They are available in a variety of mountings and with any length of stroke to meet your individual requirements. *Extra* strong cylinder walls (9/16" thick); no tie rods; makes servicing easy—either end of cylinder quickly removable.

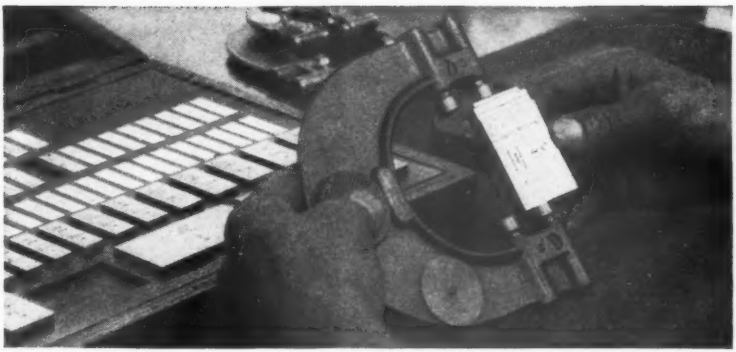
AIRGRIP

OTHER ANKER-HOLTH PRODUCTS—Air or Hydraulic 3- and 2-jaw Chucks, Collets, Arbors, Drill Press Chuck and Cylinder Combinations, 2- and 3-Jaw Finger and Compensating Chucks, Regulating Valve and Lubricator Assemblies, 3 or 4-Way Air Valves (hand or foot operated), Pressure Regulating Valves. Also Hydraulic Supercharged Power Units.

ANKER-HOLTH MFG. CO. 2735 Connors St., Port Huron, Mich.

Representatives in all Principal Cities 1720

When buying new lathes, specify "AIRGRIP" Chucks and Cylinders



Tolerances Worth Maintaining Are Worth Jo-Block Protection

When you set up dimensional inspection tolerances, it's to insure a specified class of fit in assembly, or to make sure of parts-interchangeability, or for some other good reason. The harder it is for an inspector to be *sure* he's staying within limits, *the more it costs*.

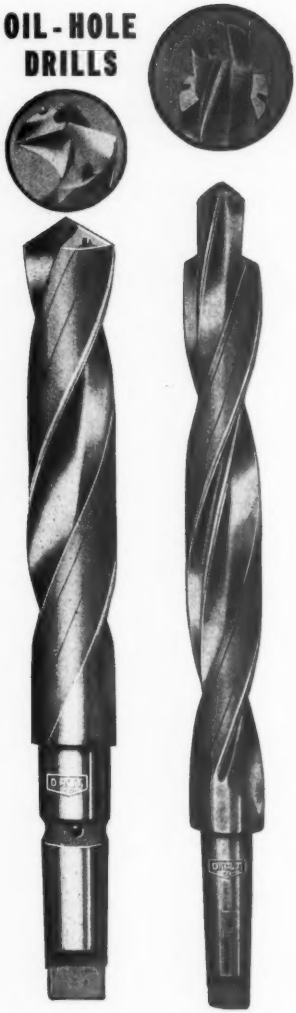
So, why not put a set of Ford Jo-Blocks on guard? Make it part of somebody's routine to check every working gage—whether snap-gage, micrometer caliper, dial indicator, plug-gage, ring-gage, or any other dimensional test device—with genuine Ford Jo-Blocks at definite, frequent intervals. Then, you'll *know* that everybody concerned is "speaking the same language" of measurement. Chances are that inspection will speed up and rejections will be fewer.

Jo-Blocks are not expensive. They're made to three warranted accuracy standards—plus or minus .000002″, .000004″ and .000008″. Sold throughout the Americas as single blocks or in sets (metric measurement, too). Many accessories available to expand and facilitate use of Jo-Blocks.

FREE—NEW CATALOG

Write for catalog No. 17, containing illustrated applications of dozens of Jo-Block uses. Address: Ford Motor Company, Johansson Division, Dept. 515, Dearborn, Michigan.

OIL-HOLE DRILLS



Oil-Hole Drill

Subland or Dual Diameter Oil-Hole Drill

Straight or Taper Shank

TOP QUALITY IN CUTTING TOOLS

•

TOP SPEED IN DELIVERY

*Oil hole drills
*Oil hole subland drills
Oil hole subland reamers
Subland drills
Subland reamers
Circularity relieved reamers
Circularity relieved end mills
Combination drill and reamer
Special drills and reamers
Line reamers
Core drills
Special Center drills
Special counterbores
Special countersinks
Flat and circular form tools
Special tools to your specifications

*Illustrated

Detroit Reamer & Tool Co.

2830 E. 7-Mile Road Detroit 12, Michigan

Write for QUOTATION

"WE GET SMOOTHER—TRUE HOLES FIVE TIMES AS FAST—

With the Sunnen Precision Honing Machine"

—CHANDLER MACHINE CO.

Hardened steel parts, bearings, connecting links, and other parts going into their sewing machines have been honed for several years at the Chandler Machine Company of Ayer, Mass.

Tolerance is held within .00025" with a very smooth mirror finish on the honed surface. Previous to using Sunnen honing, these parts were lapped — and copper laps were constantly wearing out, leaving bell-shaped holes. In addition to spoiling materials, lapping was costing them a great amount of unnecessary production time.

Now, the Sunnen Precision Honing Machine is giving them smoother finishes in more accurate holes — *at least* five times as fast.

If you have an internal finishing problem on which you need greater accuracy — or more speed — or a smoother finish, ask a Sunnen engineer to call, or write for a free bulletin giving complete details of Sunnen Honing.

SUNNEN

SUNNEN PRODUCTS COMPANY

7947 Manchester Ave., St. Louis 17, Mo.

Canadian Factory: Chatham, Ontario

Typical Jobs

Cast Iron Valve Stem Guide. 1/2 to one thousandth removed — 220 pieces per hour. Better finish and straighter hole.

Carbureter Idler Valve Jet. Hole is honed after reaming for smooth action.

Stainless Steel Load Compensator Valve Seat. Hole is honed to .0002" limit.

Inner Bearing Ring "Accurately removes last 'tenth' of stock."

Diesel Engine Fuel Injector Cylinder "So accurate that a piston can be fit within .00005 inch."

Meet Production Demands

DIEBEL HI $\frac{550}{RPM}$ SPEED PUNCH PRESS

Small Metal Stampings

TERMINALS — LUGS — WASHERS, ETC:

THIS SMALL

Accurate Punch Press Provides Speed and Economical Production

THINK

Up to 550 Strokes per Minute and Fully Automatic

IDEAL FOR PLASTICS — PAPER — FIBRE

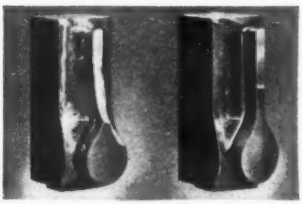
Write Immediately for Full Particulars

DI MACHINE CORPORATION

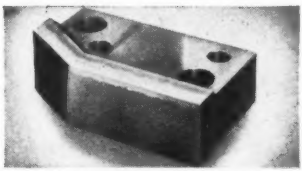
Division of Diebel Die & Mfg. Co.

3653 North Lincoln Avenue, Chicago 13, Illinois

The Pioneers of Tool and Die
WELDING ELECTRODES
Can Effect Savings in Your Plant!



Die Unit repaired with Eureka Tool and Die Welding Electrodes. No heat treatment required.



Compositely Constructed Die Unit using Eureka Tool and Die Welding Electrodes. No heat treatment required.

You can save many man hours, conserve material and minimize production delays. Tool steel welding can be used profitably in any plant using tools and dies. Here's how it can be done:

1 REPAIRING DIES . . . Existing units that may fail in operation can be welded, either partially or wholly, resulting in a minimum of "down-time".

2 COMPOSITE FABRICATING . . . Die units can be compositely fabricated, when practical, by welding, resulting in numerous advantages.

3 CORRECTING DESIGN . . . Welding facilitates making changes in contour, corners or edges during die "try out" or "change over" periods.

4 RECTIFYING ERRORS . . . Welding permits the correction of errors made in tool and die manufacturing resulting in great savings.

For complete information write for technical catalog

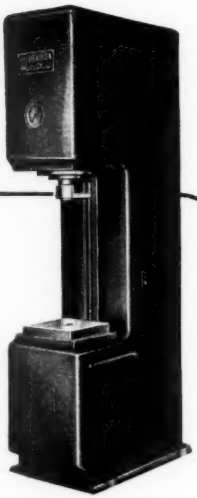
EUREKA TOOL STEEL ELECTRODES FOR FINDING THE SPOT

Welding Equipment & Supply Co.

PIONEERS IN TOOL AND DIE WELDING ELECTRODES

223 LEIB STREET • FITZROY 3715 • DETROIT 7, MICHIGAN

An ASSEMBLY PRESS for Wide-Range Service



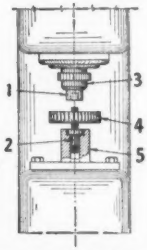
Because it is a Denison HydrOILic Press, and because it was designed specifically for assembly operations, the AC2 Series Units have the speed, power and control best suited for work of this nature.

And their utility is not limited to assembly . . . the open, C type frame with modern, all welded construction, affords ample space—daylight opening, throat depth, worktable surface—for rapid tooling up on hundreds of production operations.

Uniform pressure is applied throughout the ram's complete working cycle, and pressures may be predetermined and regulated. Ram exerts pressure upon contacting the work anywhere within its pre-set limits of movement, and returns to the up position when control lever is released.

Economical to own, operate and maintain, this completely self-contained unit will answer your need for an all purpose press.

The AC2 units are available in 5, 15, 25, 50, 100 and 150-ton capacities. They exemplify the smooth, easily regulated, quality press performance of all Denison HydrOILic presses.

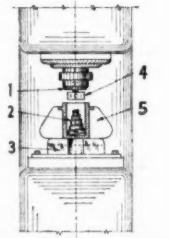


1-Ram Tool, 2-Shaft, 3-Ram, 4-Gear, 5-Holding Fixture

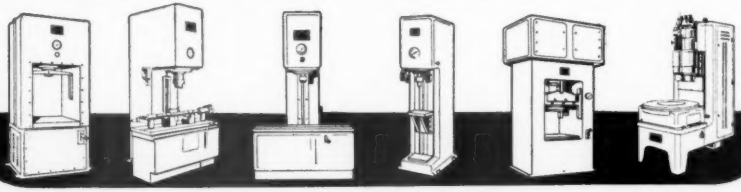
Complete information on Denison HydrOILic products is available on request—write today for details on the AC2 and other presses.

Denison makes the Multipress!

The DENISON Engineering Co.
1197 Dublin Rd. • Columbus 16, Ohio



1-Ram Tool, 2-Spring, 3-Fixture, 4-Ram Nose Piece, 5-Casting



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IMMEDIATE DELIVERY

VALVE OPENS BY FLEXING

Patented:
Nos. 1,864,978, 2,015,923
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HECO

FLEX-TIP AIR BLOW GUN

The Original Flexible Tip Blow Gun. Positive, snappy action. Flex the tip for a gentle puff or a steady stream of high velocity. Light weight, sturdy, streamlined, indestructible. Plated, hardened steel nose. You can drop it, throw it on the concrete floor, drag it around and through machinery without injury to blow-gun or machine. No Handles. No Levers. No Triggers. No Push-buttons. No Springs. No Packings. No Leaks. Nothing to break, clog, or get out of adjustment. Furnished in standard 1/4" pipe thread.

Price, $1.00 each

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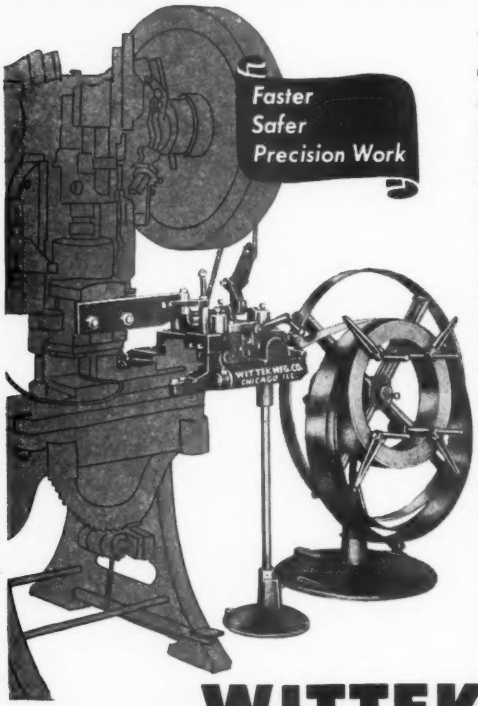
TESTED AND HECO PROVED PRODUCTS

HECKETHORN MFG. & SUPPLY CO. LITTLETON COLORADO

Planning Peacetime Production Using Coiled Strip Stock?

Equip with
WITTEK
Automatic Roll Feeds and Reel Stands



Wittek Roll Feeds are being used extensively by war plants in their large volume production of high quality metal stampings. The flexibility of Wittek Roll Feeds will assist these plants in their peacetime conversion through their adaptability to various jobs. Keen competition will demand the utilization of equipment to its point of highest efficiency. If your postwar plans include punch press production of parts from coiled strip stock—investigate now the many possibilities of Wittek Roll Feeds and Reel Stands.

Write for catalog, prices and recommendations

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MANUFACTURING CO.
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Automatic
ROLL FEEDS
AND
REEL STANDS

PRECISION REID SURFACE GRINDERS

46 YEARS of PRECISION MANUFACTURING

You Will Find Reid Precision Surface Grinders built to handle your work in an efficient and time-saving way. Every possible improvement has been made to assure you close tolerance and a finer finish at lower cost. All working parts are designed and fitted to prevent abrasives from penetrating and causing undue wear. Accessibility and new design of handwheels assure you accurate fingertip control. An outstanding precision machine.

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MODERATE COST

Illustrated is the REID Model 2-B
All-Electric Power Feed.

The Reid Model 2-C Hand Feed also is an exceptional machine for tool, gage, die and certain production grinding.

MACHINES EQUIPPED FOR WET GRINDING IF REQUIRED

EXCELLENT DELIVERIES

Distributors conveniently located in all sections.

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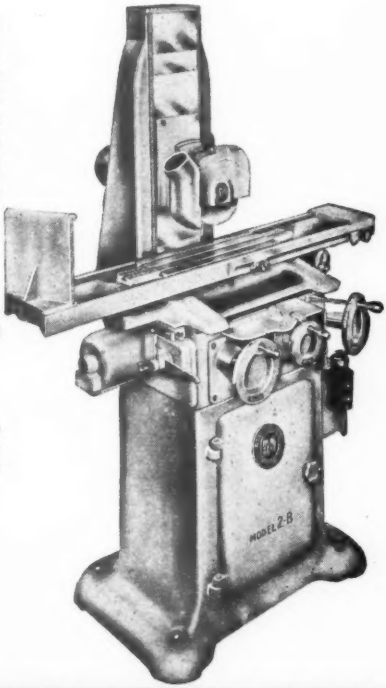

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BEVERLY MASSACHUSETTS

THEY ARE *dependable-*

They never stop—fair weather or foul—day and night the iron horse rolls, delivering the goods of a nation—they are dependable.

Behind the scenes, men and machines work to keep the iron horse healthy.

Cincinnati Shapers—rugged, sturdy and versatile—work in Railroad Shops from coast to coast—they are dependable.

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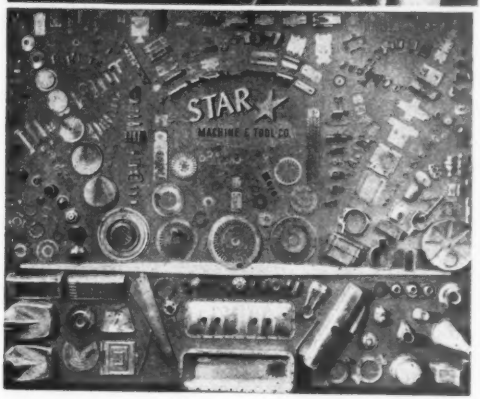
THE CINCINNATI SHAPER CO.

CINCINNATI 25, OHIO U.S.A.

SHAPERS - SHEARS - BRAKES



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Star commenced to build dies a long time ago—way back in 1902. We've built dies of all types and sizes, in our time, including many unusual and tough jobs, and we've accumulated a degree of experience and skill in die making that, we believe, is not excelled, anywhere.

We have an unusual production department, too, operated quite independently of our tool and die shop—a department capable of starting from your blue print or sample and carrying your job through tooling to final assembly, equipped with ample facilities for the manufacture of your metal component parts or complete products in any quantity.

Founded in 1902

Custom Tool and Die Makers

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Save Time ON RETOOLING OPERATIONS

WITH

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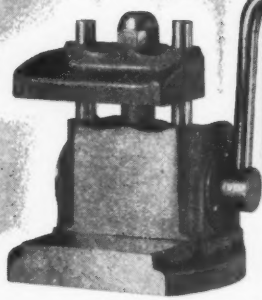
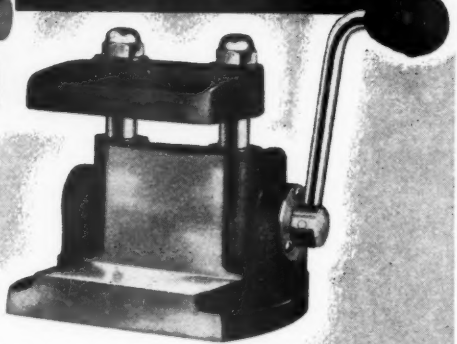
MIDGET-TYPE PRECISION JIGS



No. 4900 Work area 1⅛ x 2 inches

NEW MIDGET SIZES

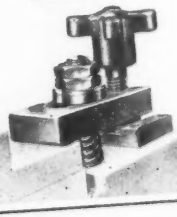


No. 4950 Work area 1½ x 3 inches

Manufacturers of

SIEWEK

Clamps and Fittings



These *new*, precision-built small-size SIEWEK units simplify drilling set-ups for a large variety of *precision* work. Both models are designed for speed and accuracy. Work is held beween two accurately parallel surfaces by a powerful positive lock.

One Siewek Midget-type Jig—with new top plate and appropriate bushing, provides a *new* jig—*at a fraction of the cost of a new unit.* Handles and lock are quickly interchangeable for right or left hand operation.

Save designing and tool room time . . . Avoid excess "idle time" for drill presses . . . Speed-up re-tooling. Write today for complete descriptions and dimensional drawings. Prices: No. 4900: $39.50 net; No. 4950: $42.50—f.o.b. Ferndale, Michigan. Extra top plates: $4.50 each.

SIEWEK TOOL DIVISION • DOMESTIC INDUSTRIES, INC.
231 South La Salle Street • Chicago 4, Illinois

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DOMESTIC DI INDUSTRIES

IT CAN REACH MANY SURFACES

THE Hand Cut Cone Shape is one of the most popular in the line of Nicholson Rotary Files—largely because of its versatility. Its straight-sloped side can be used for cleaning flat, concave and even convex surfaces. It can get into narrow rounded corners. It can be used for burring and enlarging holes. It reduces the number of tool changes when working on irregular parts.

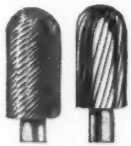
Equally important, of course, is its high Nicholson quality—in steel, in careful cut, in perfect concentricity. Fast cutting, easy control, long serviceable life make it a big money-making small tool in many shops and production lines.

WRITE FOR CATALOG AND PRICE LIST
—and for any desired special information.

NICHOLSON FILE CO., 95 ACORN STREET, PROVIDENCE 1, R. I.
(In Canada, Port Hope, Ont.)

16 STANDARD SHAPES

—in either Hand Cut or Ground. Three cuts — Coarse, Medium, Fine. Stock diameters — 1/8" to 1 1/8". No multiplicity of closely related shapes in the Nicholson line! Simplifies ordering — and tool - equipment.



HAND CUT GROUND

NICHOLSON ROTARY FILES
HAND CUT AND GROUND—FOR EVERY PURPOSE

NICHOLSON U.S.A.

To help increase "Take-Home Savings"

The Treasury Department has published two new booklets to help you and your employees realize the utmost benefit from your Payroll Savings Plan.

"Peacetime Payroll Savings Plan" for key executives offers helpful suggestions on the conduct of the Payroll Savings Plan.

"This Time It's For You" is for distribution to employees. It explains graphically how this convenient, easy thrift habit works. It suggests goals to save for and how much to set aside regularly in order to attain their objectives.

If you have not received these two booklets, or desire additional quantities, communicate with your State Director of the Treasury Department's Savings Bond Division.

The Treasury Department acknowledges with appreciation the publication of this message by

TOOL & DIE JOURNAL STAFF

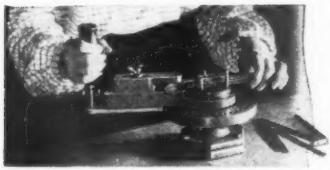
This is an official U. S. Treasury advertisement prepared under the auspices of the Treasury Department and Advertising Council

Talk About PRODUCTION Without DIES!

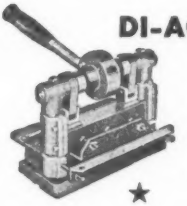
4,000 PARTS per DAY with DI-ACRO Bender

"Enclosed pictures in our plant prove the DI-ACRO Bender will do a real production job. We are making 4,000 completed parts per day which is competitive to most Power Presses." (Name on Request.)

Here is an example of "DIE-LESS DUPLICATING" typical of a great variety of formed parts readily made with DI-ACRO Precision Machines, — Benders, Brakes, Shears. Picture below shows the DI-ACRO Bender making an acute right angle bend and photograph above shows the finished part formed to die precision. Women operating DI-ACRO units maintain a high out-put on production work.



Pronounced "DIE-ACK-RO"



DI-ACRO Shear

Squares and sizes material, cuts strips, makes slits or notches, trims duplicated stampings. 3 sizes. Shearing widths, 6", 9", 12".

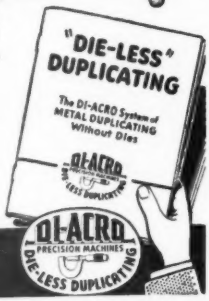
★

DI-ACRO Brake

Forms non-stock angles, channels or "Vees". Right or left hand operation. 3 sizes. Folding widths, 6", 12", 18".

Send for Catalog

showing DI-ACRO Precision Machines and many examples of parts made with "DIE-LESS DUPLICATING".



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"Your magazine helps us in many ways with our problems. We cannot keep shop without it." PURCHASING AGENT

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"A very valuable source of buying information and a means of keeping up to date with new tools, techniques, etc." SHOP SUPERINTENDENT

"I find your Inform-A-Gram and Where Can I Buy It departments most helpful and convenient." PROJECT MANAGER

"This is the most useful magazine on tools we have received." WORKS MANAGER

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"We find it a pleasure to advise you that our advertisement in TOOL & DIE JOURNAL has brought results far beyond our expectations, not only in inquiries but also in actual orders.

The first ad has paid for itself in less than thirty days." MANUFACTURER OF TOOLS, DIES AND METAL STAMPINGS

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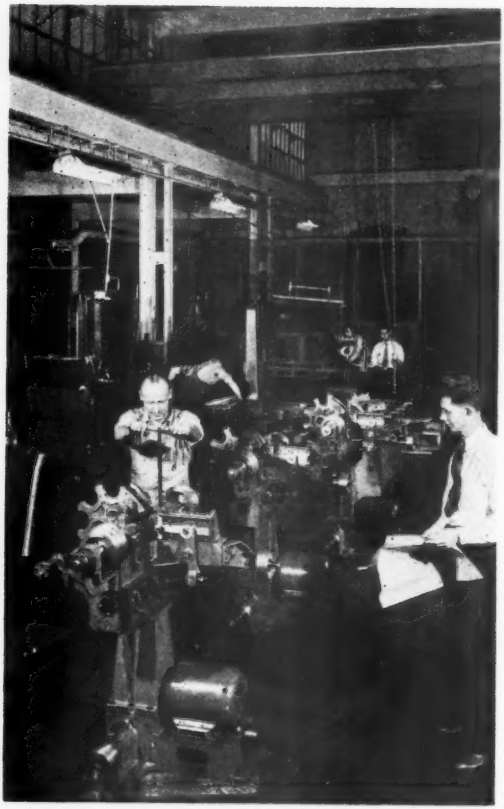

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The Habit of Precision
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PRECISION MEASURING INSTRUMENTS

machine skills vs. human skills

The dominant themes of February's Metal Exposition of the American Society for Metals and the April Tool Show of the American Society of Tool Engineers were based on lower production costs, hence lower selling prices which induce and permit more people to buy more goods. The end result of more people wanting and buying more goods is that more people (buyers) are more gainfully employed in turning out more goods.

That is the economic cycle on which we stake our future prosperity. It is the American way and is proved by our state of economic well-being as compared to other nations and other economies.

The lower cost and higher production aspects of our economy were in dramatic evidence at the two expositions. These highly mechanized production processes stem from highly specialized machines and tooling that permit direct labor to produce more and at lower unit cost and, withal, at the higher wages that prevail today, which is as it should be.

During the war, machine design and production tooling met the challenge of the demand for a manyfold increase in our total output of (war) goods by a program of simplification and streamlining that enabled theretofore unskilled labor, with a minimum of training, to perform adequately the functions of machine operation.

Now, postwar, these same trends in machine design and tooling are resulting in still further diminution of labor skills. The result is, in many cases, that a job may call for a machine tender or observer rather than a machine operator.

With this, too, we can have no quarrel, for if, by a sedentary routine of button-pushing operations, a man can produce, at higher pay, more goods, cheaper than heretofore, for more people to want and buy so that still more employment will be created, that is certainly a net gain, and he can get his exercise by more gardening, bowling or golf.

BUT, what this does head up to is an increasing disparity between the highly skilled toolmaker or master mechanic and the production worker; a greater dependence by and for production on those who are trained by experience to design and build the machines and tools that make production itself

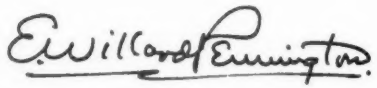
simple and foolproof.

As production becomes more of a push-button operation, the toolroom and development machine shop will assume greater and greater importance as a training and proving ground for toolmakers, expert machinists and master mechanics.

Ahead of the training program there is a first magnitude selling job. Youth should be informed of and impressed by the importance to industry and to our economy of this line of endeavor. A strong appeal can be based on the pride in craftsmanship that comes through painstaking training and the successful accomplishment of difficult jobs; jobs that can be made easier only by practical know-how. The appeal can be personalized by enlisting the aid of outstanding masters of the trade who are broad-minded and enthusiastic enough to be willing to pass down to the apprentice and learner those skills, shortcuts and time-proved practices that they learned the hard way. It can be pointed out that a truly skilled craftsman enjoys a higher degree of economic security than can be attained by governmental dictate or political promise.

"You can't take it with you" applies only to material things. Personal skills, unless conscientiously passed on from one generation to another, become diluted and dissipated to the vanishing point.

Most logically, this selling and training falls in the lap of the tool and die industry. We do not propose such a Hollywood technique in glorifying the toolmaker that every small boy will want to be one to the extent that we were all going to be locomotive engineers. But, if the tool and die industry can do half the job of selling itself to the youth of the country that Studebaker has done in promoting the idea of Studebaker-South Bend second and third generation skills and pride in craftsmanship, the tool and die industry itself will be the first and foremost beneficiary.



editor

Die Steel for Hot and Cold Work

Aluminum Company of America.

Drawing aluminum tubing through steel dies.

Steels with properties that have made them suitable for working other steels, wrought iron, and non-ferrous metals and alloys, or for forming them hot or cold into nearly any desired shape, have been in use from the beginning of man's efforts in blacksmith shops to hand forge them into useful products. Ever seeking to improve the tools with which he has had to work, for such reasons as faster production, more production per tool, greater power applied in deformation of work, and lower production cost, special steels have been developed to meet these increasing demands and specialized needs.

by W. H. Wills
METALLURGICAL ENGINEER of TOOL STEELS
Allegheny Ludlum Steel Corporation
Dunkirk, N. Y.

Die steels for hot work have been greatly improved and have kept pace with developments in production forging operations and related processes. These improvements have branched out in several directions as special grades have been produced because of the variety of

Aluminum Company of America.

Filing a die for extruding aluminum channel.

Aluminum Company of America.

Extrusion of aluminum shapes requires hot work die steels.

equipment or machine tools with which such steels are used to work hot metal, and because of the differences in the properties of the hot metals and alloys that are worked by means of dies.

A die was seldom required in early blacksmith shops, or if used, was simple in shape and subject to low enough strains or to small enough production to permit the use of cast iron or straight carbon tool steel. Later, when steam hammers, drop hammers, and power upset forging machines came into use, and mass production was required, the necessity for highest quality die materials became obvious. A demand for still better die steels grew with more recent increases in size and speed of operation of mechanical and hydraulic presses for forging of steel, and for forging and extrusion of copper alloys and other nonferrous alloys. Extensive development of die casting of zinc, aluminum, and other alloys also required better die steels. Extrusion of stainless steel and other alloys will become a practical production process only when die steels that give satisfactory performance are available.

The operation of hot working equipment subjects die steels to a wide range of pressures as well as to heat, abrasion, and shock. As forging equipment improved, speed of operation was increased and production runs were lengthened. The original hot die material, carbon tool steel, was no longer satisfactory because the dies would soften and wash out at the higher operating temperatures. When the valuable quality of red hardness, which is imparted by alloying, was discovered in connection with high speed steel for cutting tools, these alloys were also applied to hot work die steels with greatly improved results. These steels also resist wear and heat checking better than straight carbon tool steel.

Hot work alloy steels contain relatively low carbon. Two or more of the alloying metals, tungsten, chromium, vanadium, molybdenum and nickel, are usually present in the steel. The various combinations were discovered over a period of years as the result of the joint experience of different steel makers and users.

These tool steels should not be confused with the low chrome-nickel and chrome-nickel-moly steels, mostly of open-hearth manufacture, which are used largely for die blocks. These steels do not resist heat and washing out like the more highly alloyed hot die steels. They are used for comparatively short runs and for dies of large size when die steel cost must be considered.

Alloy steels for hot dies may be di-

vided roughly into two classes; one in which chromium is the principal alloying element and the other in which tungsten or molybdenum predominates. Some steels contain approximately equal amounts of tungsten and chromium. Table I gives the analyses of the more important steels of each class.

The variety of operating conditions make it difficult to formulate rules for selecting hot die steels. Selection should be made after consideration of several factors, including experience, service tests, knowledge of hot hardness and other physical tests. Other factors are:

1. Size or volume of the forging with respect to that of the tools. If relatively small, the large radiating area of the tool prevents the die from reaching as high a temperature as dies of relatively small size.

2. Number of pieces to be produced and rate of production. In a slow acting press the tools and work are in contact longer, thus producing a higher temperature in the die and resulting in more rapid deterioration. The rate of production of an automatic feed rivet machine is usually 50 percent faster than a hand machine, thus subjecting the header and gripper dies to appreciably more heat.

3. Size tolerance of work. Close tolerances require a better grade of hot die steel to get satisfactory die life.

4. Method of cooling tools. Water, steam, oil, and air are used in cooling tools. Sometimes no cooling is practical. Water cooling should be applied sparingly or not at all on tungsten hot die steels because of cracking hazards.

5. Shock resistance. When deep impression dies are required because of the shape of the product, and heavy strains must be withstood, shock resisting steels should be selected.

Properties and Applications

The older chrome steels for hot work, usually containing 4 percent chromium and 0.75 to 1.00 carbon, were commonly used for hot header and gripper dies on bolts and rivets. The trend in recent years has been to lower the carbon content and add 0.50 to 0.75 percent molybdenum and vanadium. Thus improved, these steels resist water cooling in service better than tungsten steels and withstand operating temperatures of 900° to 1000° F fairly well. They can be hardened by quenching in oil to develop moderately high hardness and are suitable for some cold work applications in which the comparatively shallow hardening carbon tool steel tends to sink.

The 5-percent chrome type steel in Table I was developed later for aluminum die casting molds, but its use has spread to many other applications and it has become a general purpose hot work die steel. With a low carbon content it has excellent resistance to shock and sudden temperature changes. It is made with about 1.25 percent tungsten and without tungsten, the latter being usually preferred for die casting molds that are internally water cooled.

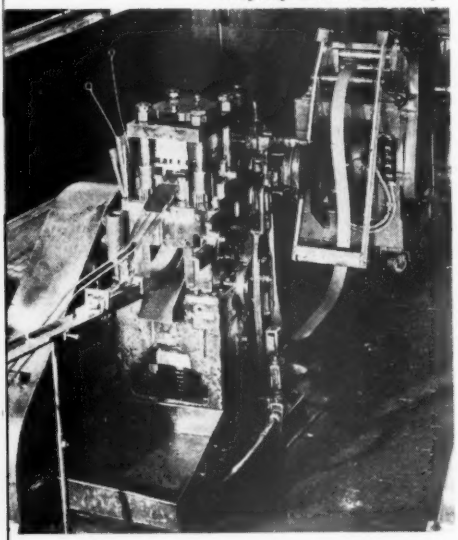
The 5-percent chrome tool steels were

TABLE I—TYPES OF HOT WORK DIE STEELS

	C	Mn	Si	Cr	V	W	Mo
A. Chromium Types							
A-1. Chromium	.65	.30	.25	4.00	.50	....	.70
A-2. Chrome-Moly	.35	.30	1.00	5.00	.30	1.25 (opt.)	1.50
B. Tungsten Types							
B-1. 9% Tungsten	.30	.25	.25	3.00	.50	9.00	....
B-2. 12% W	.40	.25	.25	3.00	.50	12.00	....
B-3. 14% W	.45	.25	.25	3.50	.75	14.00	....
B-4. 18% W	.50	.25	.25	4.00	1.00	18.00	....
C. Molybdenum Types							
C-1	.40	.25	.25	3.75	.75	1.00	5.75
C-2	.60	.25	.25	3.75	1.10	1.50	8.50

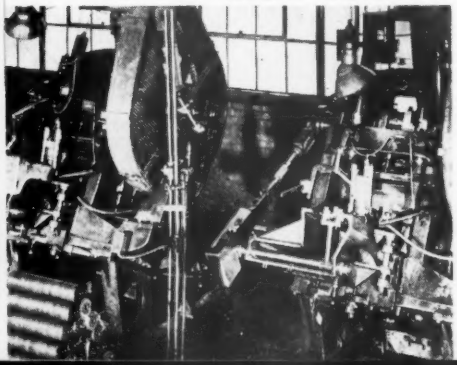
60-ton presses equipped with a trigger slide feeding arrangement for producing rotors from disks. These dies are precision sectional type made of Huron to insure long die life. Dies of this type will produce approximately 5 to 8 million rotors for each 1¼ inch of die wear.

Allegheny Ludlum Steel Corp.



Standard 25-ton press for producing transformer laminations (E & I type) from alloy coil. Die is sectional progressive style, using Huron die steel on all cutting edges—hardened to 62-64 Rockwell "C" to resist wear.

Allegheny Ludlum Steel Corp.



used in large quantities during the war for shell piercing points on presses after numerous comparative tests with other grades proved its merit. They are used for hot punching and forming dies (including Maxipres dies), forging machine plungers and die inserts, and many other hot work dies subject to shock. In the extrusion of aluminum and other nonferrous metals worked in the lower temperature range, it is used for dies, dummy and backer blocks, and other extrusion press tools.

Tungsten hot die steels have greater red hardness than the chrome types and maintain fair hardness up to 1150° to 1200° F. This improved resistance to erosion or washing out is important when the work must be held to close size tolerances. The wide use of these higher cost steels is indicative of the better production obtained.

Tungsten steels require hardening temperatures of 1900° to 2100° F or more as compared with the lower range of 1750° to 1850° F for chrome steels. In general, cooling in air is preferable to oil quenching, especially with large sections and intricate shapes. When tools must be cooled in service a current of dry air is better than water.

Although only one carbon content is shown for each tungsten steel in Table I, steels B1, B2 and B3 are made in a range of 0.25 to 0.50 carbon. The lower carbon steels have greater toughness and are generally recommended for deep impression dies or those subject to shock. Impact strength is reduced with increase of carbon but wear resistance is increased.

Steel B1 resists shock and sudden temperature changes, and is less liable to crack than the others of the group if water cooling is necessary. Its principal applications include hot nut tools, including cut-offs, side dies and piercers, hot forming dies with deep cavities, and brass die casting dies.

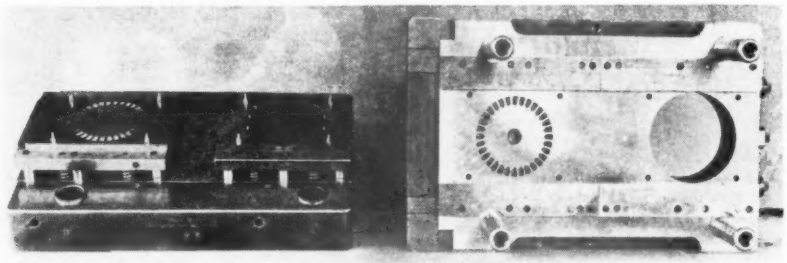
Steel B2 is harder but less tough than B1, although physical properties at 1000° to 1200° F are nearly the same. It is suitable for brass and copper forging dies, dummy blocks, hot swaging dies, hot forming punches and dies, and forging die inserts.

Steels B3 and B4 are the best of the group for resistance to abrasion. They

TABLE II—TYPES OF COLD WORK DIE STEELS

Type	C	Mn	Si	Cr	V	W	Mo	Ni
A. Water Hardening Steels								
Carbon	1.00	.25	.20	...	...	...	...	
Carbon-Van	1.00	.25	.20	...	.25	...	...	
B. Manganese Oil Hardening								
High Mang	.90	1.60	.20	...	.30*	...	.30*	
Mang.-Cr.-W	.90	1.15	.20	.50	...	.50	...	
Tungsten-Cr	1.20	.30	.25	.50	.20	1.50	...	
C. High Carbon, High Chromium (Oil Hardening)								
2% Carbon-12% Chrome	2.15	.30	.30	12.00	1.00*	1.00*	...	.50*
D. (Air Hardening)								
1.50 Carbon-12% Chrome	1.50	.30	.30	12.00	.25	...	.80	
5% Chrome	1.00	.30	.30	5.00	.25	...	1.00	
Manganese	1.00	3.00	.30	1.00	...	...	1.00	

*Optional



Allegheny Ludlum Steel Corp.

High production precision stator lamination die. All cutting die parts are made of Huron tool steel, hardened to Rockwell 62-64 "C" for resistance to the high abrasion action of silicon steel. Ground sectional progressive dies of this type produce approximately 4 to 6 million laminations. This is a 100-ton die.

should not be subjected to shock loads, since their toughness is less, unless it is possible to use a tough steel backing. Applications of these steels include shear blades or cut-offs on hot work, punches and dies on long runs where resistance to abrasion as well as to heat is important, gripper and hot forming dies with shallow impressions, hot drawing dies, hot press die inserts, hot trimmer dies, brass and copper alloy extrusion dies.

The high molybdenum hot die steels are relatively new. Their use increased during the war when the use of tungsten was restricted. Steel C1 in Table I has properties and uses somewhat comparable to B2, and C2 bears the same relation to B4. These steels, like the high molybdenum high speed steels, are more subject to decarburization than the tungsten types, thus making precautions necessary in heating operations.

Cold Work Die Steels

Die steels for cold work are of practically the same importance as cutting tool group, from the standpoint of number and variety of applications. Whenever metal articles are to be manufactured by mass production methods, there is a good chance that stamping, forming, drawing, cold heading or upsetting processes, all of which are accomplished with cold working dies and punches, will

be utilized in making one or more parts of the product.

Application of these methods was given its biggest boost in the mass production of automobiles, for which some of the largest dies have been put into service for body work. These methods have been applied recently in the production of stressed parts of a small 4-cylinder gasoline engine. Methods developed in this industry have been applied to aircraft, refrigerators, washing machines, kitchen sink units, and other household appliances, lawn mowers, business machines, vending machines, farm implements and many others.

Heavier stampings have often replaced forgings or castings. In long runs of light material as well as in producing heavier parts, long tool life is essential in resisting severe service. Such mass production items as bolts, cap screws, and related products, produced by cold heading or upsetting processes, also require die steels that will withstand long service. In stamping laminations of silicon steel for electrical equipment, size accuracy and quantities sometimes in the millions call for the best there is in cold work die steels.

Because of differences in requirements of cold working dies, a number of different steels have been developed. They are classified into several groups, according to characteristics and physical properties. The principal groups, given in Table II, are distinguished mainly by the hardening method.

Selection of the best die steel for a given application is influenced by such factors as the type of operation, characteristics of the materials worked, number of pieces to be produced, dimensional tolerances, and costs of dies. The development of die steels was the result of growing demands for materials that would meet increasingly severe service requirements at lower costs.

Water Hardening Steels

The first material of which dies for cold work were made was a steel containing approximately 1.00 percent carbon. Until about 1925 it was melted in a crucible furnace. Since then carbon tool steel has been made largely in electric furnaces. For many applications, carbon tool steels still show advantages, which maintain a demand for large quantities, including lower grades melted in open hearth furnaces.

Although carbon tool steel is usually hardened at about 1450° F, it has a wide hardening range and its grain structure will not be excessively coarsened by temperatures up to 1550° F. The water or brine quench, though drastic, develops a hard case over a softer core. This has an important advantage in absorbing shock.

Two reasons for the development of other cold work die steels are (1) that the depth of case of carbon tool steel limits the number of regrinds on dies that must be dressed and (2) that warpage and relatively large change in dimensions during hardening are often problems. Furthermore, in dies of intricate shape there is a hazard of cracking. However, since skills and experience differ greatly among fabricators, some can economically use water hardening steel where others would get better economy with oil or air hardening steels. On jobs in which more grinds and less chance of soft spots are desired, a medium to deep hardening carbon tool steel is generally used. When distortion must be minimized, shallow hardening is preferred.

Vanadium is added to carbon tool steel to produce greater toughness. Resistance to shock and fatigue is one of the most important advantages of carbon vanadium tool steel. This steel is usually drawn back considerably after quenching, thus sacrificing some hardness for greater toughness. Because of its resistance to grain growth, it is suitable for cold header dies and others that give best results when hardened at temperatures considerably over the critical range.

Oil Hardening Steels

One of the first alloy tool steels is manganese oil hardening, non-shrinking or non-deforming steel. The less severe oil quench is made possible by 1.00 to 1.50 percent or more manganese. This steel can be made file hard in sections of ordinary size (approximately 4 x 1 in.). The maximum hardness is slightly less than that of straight carbon steel quenched in water or brine. These steels

(CONTINUED ON PAGE 122)

Deep Drawing Filter Cases

Part III*

(continued)

The third part of this series, which covers the deep drawing operations performed on the presses of the Belleview (Ohio) Manufacturing Company in producing the cases for Fram Oil Filters, continues with details of the tooling for the third draw and subsequent forming operations.

by Carl J. Nagel

The dimensions of the filter case shell, as it comes to the third operation draw from the second, are of 8" diameter and 9" depth.

Figure 9 shows in cross-sectional detail the upper and lower die construction of the tooling for the third draw and gives the bill of materials specified.

The machined steel upper die shoe, detail A, Figure 9, is bolted to the upper bolster plate, detail Q, at four points by standard 1" hex-head cap screws with standard 1" lock washers, details J and K.

The hardened and ground tool steel pilot punch, detail D, is bolted to the upper die shoe, detail A, by four equispaced, socket head or fillister head cap screws, as shown by detail B.

The machined steel punch adaptor, detail C, is secured to the hardened and ground tool steel punch proper, detail S, by means of the standard 2" steel stud, detail E.

The assembly, made up of the punch adaptor, detail C, and the hardened punch, detail S, and including the stud bolt fastening, is drilled through, as shown by the dotted lines, to provide air pressure relief. This precludes entrapped air when completing the draw and facilitates removing the work from the punch. To further aid removal of the

*Part I, Tool & Die Journal, July 1945
Part II, Tool & Die Journal, August and September 1945
Part III, Tool & Die Journal, February and March 1946

A display of workpieces from the several operations of blanking, forming and trimming the oil filter case.
The first installments of Part III, TDJ February and March 1946, covered A, blanking the stock to 18¼" x .062"; B, the first draw to a shell 9¾" dia x 7" deep; and C, the second draw to an 8" dia and 9" depth. The current article deals with the tooling for the third and final draw to a 6¼" dia and 11" depth and the first flattening and rib forming operations, as depicted by D and E. The first seven operations are tooled for Bliss presses and the final three are run on Ferracute, Verson and Toledo presses, respectively. The material is hot-rolled, pickled and oiled, low carbon steel blanked out from flat strip stock.

FIGURE 9 TYPE F-40 FRAM FILTER

BILL OF MATERIALS			BILL OF MATERIALS			BILL OF MATERIALS		
DET.	DESCRIPTION	REQ.	DET.	DESCRIPTION	REQ.	DET.	DESCRIPTION	REQ.
A	MACHINE STEEL UPPER DIE SHOE	1	J	STD. 1" HEX. HD. CAP SCREWS	8	S	TOOL STEEL PUNCH	1
B	STD. $\frac{1}{2}$" CAP SCREWS	4	K	STD. 1" LOCK-WASHERS	8	T	LOWER BOLSTER PLATE	1
C	MACHINE STEEL PUNCH ADAPTER	1	L	STD $\frac{1}{2}$ LOCK-WASHERS	4	U	TOOL STEEL BOTTOMING PUNCH	1
D	TOOL STEEL PILOT PUNCH	1	M	STD $\frac{1}{2}$ HEX. HD. CAP SCREWS	4			
E	STD 2"CR. STEEL STUD	1	N	MACHINE STEEL BOTTOMING PUNCH ADAPTERS	1			
F	TOOL STEEL DIE RING	1	P	STD. 1" MACHINE BOLT	1			
G	MACHINE STEEL DIE BLOCK	1	Q	UPPER BOLSTER PLATE	1			
H	PICKLED AND OILED HOT ROLLED MATERIAL STOCK	1	R	STD. $\frac{3}{4}$" CAP SCREW	4			

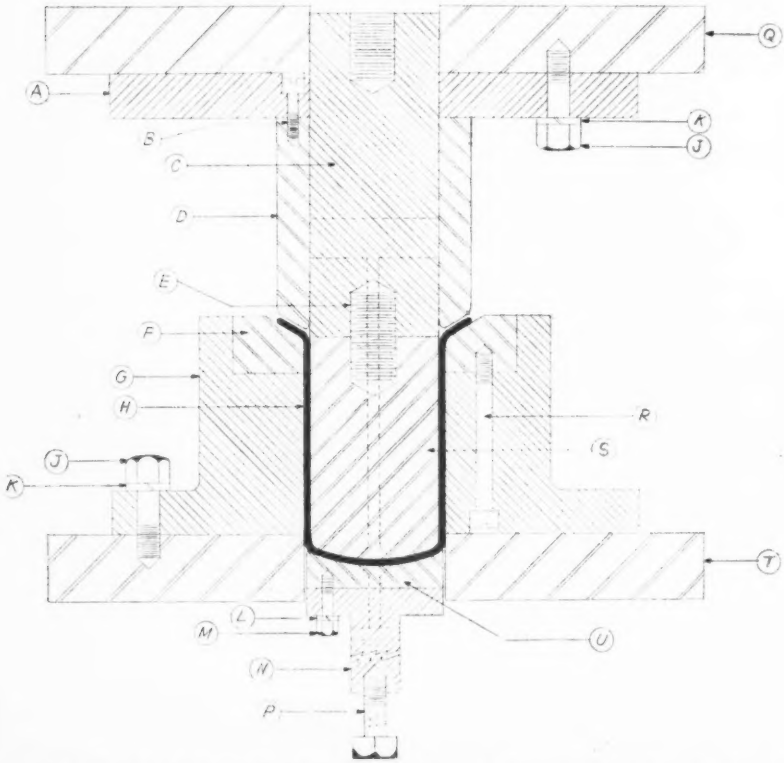


Figure 9. Details of the tooling for the third draw of the case from its 8" dia and 9" depth to 6¼" dia and 11" depth.

The work as it comes from the press tooling of Figure 9 upon completion of the third draw. The shell has been reduced from an 8" dia and 9" depth to 6¼" dia and 11" depth.

work, the punch adaptor and punch assembly is given a taper of approximately 2° included angle.

The machined steel die block, detail G, Figure 9, is bolted to the lower bolster plate, detail T, using four standard 1" hex-head cap screws and standard 1" lock washers, details J and K.

The hardened and ground tool steel die ring, detail F, is bolted to the die block, detail G, by four equi-spaced, ¾" socket or fillister head cap screws. The die ring has a 30° taper (120° included angle) which blends into a ¼" drawing lip radius at point of draw.

Details U and N show the hardened and ground tool steel bottoming punch and machined steel bottoming punch adaptor. The two are secured together by four standard ½" hex-head cap screws and standard ½" lock washers, details L and M.

As in the case of the upper punch assembly, both the bottoming punch and the bottoming punch adaptor are drilled as shown by the dotted lines, to provide air pressure relief. The bottoming punch assembly also serves as a knockout for the filter cases, proper adjustment being attained by means of the standard 1" machine bolt, detail P.

Detail H, Figure 9, shows the workpiece or filter case at completion of the third operation draw. The case has been drawn to a 6¼" dia and 11" depth. As compared to the shell at the completion of the second draw (8" dia and 9" depth), this represents a reduction in OD of approximately 22% and an increase in depth of draw of also approximately 22%.

Following the third operation, the filter cases are loaded into box type, 4-wheel hand trucks for ease of handling.

Prior to the fourth operation of flattening the top flange, the upper halves of the filter shells are annealed to cherry red to preclude cracking or breakage. They are not flattened while hot but are allowed to cool before loading in the press.

In addition to flattening the top flange, the fourth operation includes impressing reinforcing ribs in the bottom of the filter case.

Figure 10 shows in detail the design

(CONTINUED ON PAGE 118)

By the tooling detailed in Figure 10 covering the fourth operation, the top flange of the case has been flattened and reinforcing ribs have been formed in the bottom.

FIGURE 10 TYPE F-40 FRAM FILTER

BILL OF MATERIALS			BILL OF MATERIALS			BILL OF MATERIALS		
DET.	DESCRIPTION	REQ.	DET.	DESCRIPTION	REQ.	DET.	DESCRIPTION	REQ.
A	MACHINE STEEL UPPER DIE BLOCK	1	J	STD. $\frac{1}{2}$" HEX. HD. CAP SCREWS	4	S	PICKLED AND OILED HOT ROLLED MATERIAL STOCK	1
B	STD. $\frac{3}{4}$" CAP SCREWS	4	K	MACHINE STEEL BOTTOMING PUNCH ADAPTER	1	T	LOWER BOLSTER PLATE	1
C	TOOL STEEL UPPER DIE RING	1	L	STD. 1" MACHINE BOLT	1	U	TOOL STEEL BOTTOMING PUNCH	1
D	TOOL STEEL LOWER DIE RING	1	M	UPPER BOLSTER PLATE	1			
E	TOOL STEEL PUNCH	1	N	MACHINE STEEL PUNCH ADAPTER	1			
F	STD. 1" LOCK-WASHERS	8	P	STD. 2" C.R. STEEL STUD	1			
G	STD. 1" HEX. HD. CAP SCREWS	8	Q	MACHINE STEEL LOWER DIE BLOCK	1			
H	STD. $\frac{1}{2}$" LOCK-WASHERS	4	R	STD. 1" CAP SCREW	4			

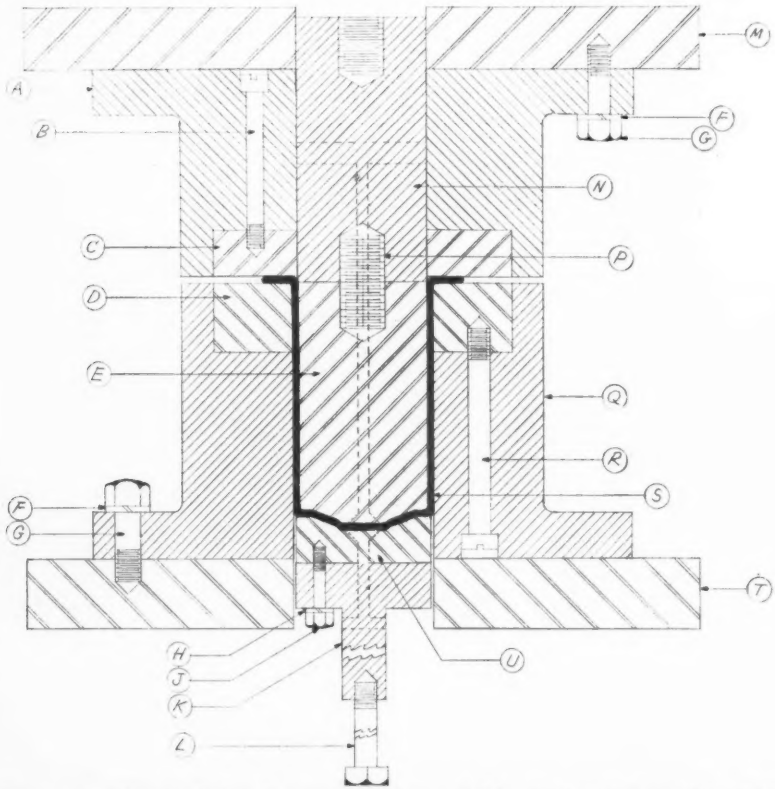


Figure 10. The detailed tooling and bill of material for the fourth operation which flattens the top flange and forms the bottom reinforcing ribs.

Costly Tools and Metal Components Protected by Plastics Coatings

Tools, especially precision and fine edged tools, lying unused in bins are often damaged by atmospheric moisture during storage. By immersing them in a bath of ethylcellulose heated to the correct temperature, they receive a thin coating which protects them against both abrasion and corrosion. Finely machined surfaces of axle shafts, complete axle assemblies, cam shafts, connecting rods, gears, intake and exhaust valves and all other metal parts having exposed, expensively produced surfaces may have this coating applied to check corrosion.

by F. L. Gerin
VICE-PRESIDENT
Youngstown Miller Company
Subsidiary of Walter Kidde & Co.

The application of this plastic compound is simple and relatively inexpensive. The coating is tough and resistant; metal parts when coated with ethylcellulose have been dipped for more than 100 hours in salt water without corroding. Test sample coatings show an elongation of 50% to 70% under a load of 460 pounds per square inch. As a result, expansion and contraction of parts under extreme temperature has no effect upon the coating.

The tools or metal parts are dipped in the plastic compound which has been brought to a molten state in a recently developed machine. A thin coating, moisture-proof and of great durability, is formed upon the surface of the metal parts as a result of the immersion. This coating is protection against chipping, handling and corrosion. The thin plastic layer is easily removed, when no longer needed, by stripping or peeling.

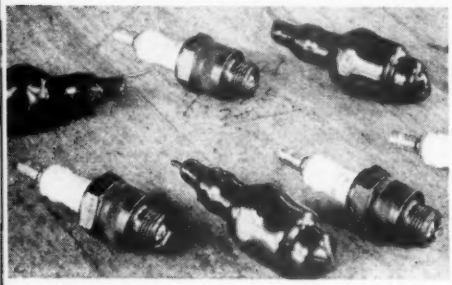
The plastics compounds which are heated in the dipping machines are manufactured by many large chemical companies. In each compound the basic ingredient is ethylcellulose.

These compounds are solid and somewhat rubbery at room temperature. To be applied as a coating to metal they must be heated to 375° F at which tem-

All metal parts must be thoroughly cleaned. If manual handling is necessary between cleaning and coating, clean gloves should be worn because fingerprints cause corrosion.

perature they are viscous but will form a satisfactory coating on parts dipped.

Developed first for Army Ordnance in late 1943, the material can now be used more generally. As its use increased, the need for special melting equipment became evident because of its sensitivity



The above are spark plugs which have been dipped in Plastic Coater. The process furnishes its own protective oil film. This is accomplished by the exudation of oil from the plastic and coming into contact with a cold object.

to excessive temperatures and the amount of time consumed in melting it down by methods not particularly adaptable. In 1944 a machine suitable for melting and applying these materials was developed.

In general, these dipping compounds are not good conductors of heat. This property had to be taken into consideration when the manufacturers of the machines for melting and maintaining the temperature of this compound were planning and designing the equipment.

Temperature uniformity is essential for the efficient and effective application of ethylcellulose coatings. The best temperature for dipping is between 375° and 385° F, temperatures so high that no organic material may be maintained at them for any considerable time without chemical breakdown. Ethylcellulose itself begins to break down at 400°. Gluepots, roasters and other primitive methods of melting the compound had been unsuccessfully tried. Today there are simple, self-contained units that hold the plastic at the correct dipping temperature. The machines meet all the requirements set up by the various military organizations sponsoring the use of protective plastic compounds and by the various compounders of the material.

After the solid plastic is placed into the melting compartments at one end of the unit, the heating system is put into action. Temperature control is automatically maintained by three separate thermostats. Electric strip heaters supply heat to an oil which is contained in a jacket lining the bottom and the four sides.

In larger sizes, a pump circulates the heated oil through melting pads which are hollow, rectangular metal sections located near the bottom of the tank. Both of these methods provide a large heat transfer surface necessary to compensate for the poor heat conductivity of the plastic. This large surface permits relatively low temperatures at the metal surface proper. There are units of various sizes. The smallest has a melting capacity of 3 pounds per hour and the largest a melting capacity up to 100 pounds of plastic per hour. In the smaller units, vertical metal plates conduct the heat efficiently into the melting compartment.

A plastic pump keeps the molten plastic continually flowing within the dipping compartment. It flows over a metal weir and then back for reheating.

Circulating the plastic in this way serves these several purposes:

1. It distributes the heat uniformly throughout the entire mass of plastic.
2. It maintains a constant level in the dipping compartment so long as there is any molten plastic in the melting compartment.
3. It prevents the formation of surface scum in the dipping compartment, a condition which occurs when motion or agitation is lacking.
4. It removes any bubbles caused by air pockets entrapped in parts being dipped. (Dipping into a bubble will give an imperfect coating.)

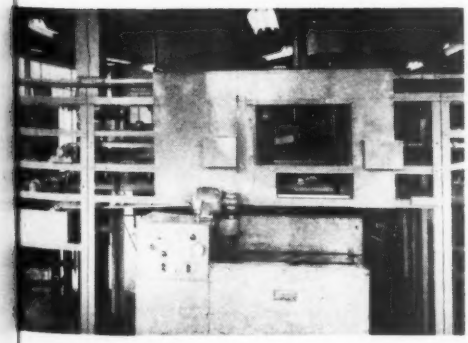
Dipping is exceedingly simple and may be done either by hand or mechanically. Mechanical dipping allows a greater uniformity of coating. Then, too, parts are subjected to less individual handling which reduces danger of contamination

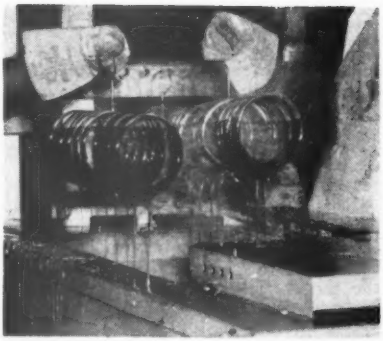
and considerably lowers packaging costs.

All metal parts must be thoroughly cleaned. If manual handling is necessary between cleaning and coating, clean gloves should be worn by operators since fingerprints from handling cause corrosion. Preservatives need not be applied to parts, but if they are used and the parts properly drained, ethylcellulose can be applied over all with no contaminating effects.

Parts may be immersed by either one operation or may be double dipped. Single dipped parts are suspended by an impregnated or waterproof string. The double dip consists of immersion of half the part in the melt, followed by immersion of the other half, leaving a lap joint. If a very quick dip has been performed in the first instance, the second dip should be slightly longer in duration in order that satisfactory bonding of the two dips is secured. A wait of only 30 seconds is generally all that is needed between these two dips. The coating reaches its permanent state almost immediately after removal from the dip because the setting of the coating is dependent only upon the cooling effect of the metal and the surrounding atmosphere.

The Corcoran-Brown Lamp Division of the Electric Auto-Lite Company has a specially built conveyor.





In Buffalo, N. Y., at the A.A.F. Package Depot, these piston rings were dipped for their trip overseas. Ethylcellulose coatings formerly used for protecting metal parts from corrosion during shipping is now an ideal coating for tools while in storage bins.

It is easily seen that the greater the temperature, the thinner the coating. As the temperature of the metal part is increased, the coating thickness decreases. If the part to be dipped is heated first, the adhesion of the coating to the metal is too great for easy removal. The metal part should be at a lower temperature than the compound to prevent this occurrence.

Time of immersion is the biggest factor affecting the coating thickness. An article dipped for ten seconds at 375° will have a coating twice as thick as one dipped for one second at the same temperature. Most small metal articles need about four seconds, but the proper time for each individual case is determined by experiment.

The metal part should be put into the coating in such a manner as to trap as little air as possible. The coating sets quickly; it is relatively hard in less than a minute. Quenching or cooling in water is not to be recommended and some military services prohibit it. If it is desirable to hasten the setting process, a blower or electric fan may be used.

Trunnion Design For Assembly Jigs

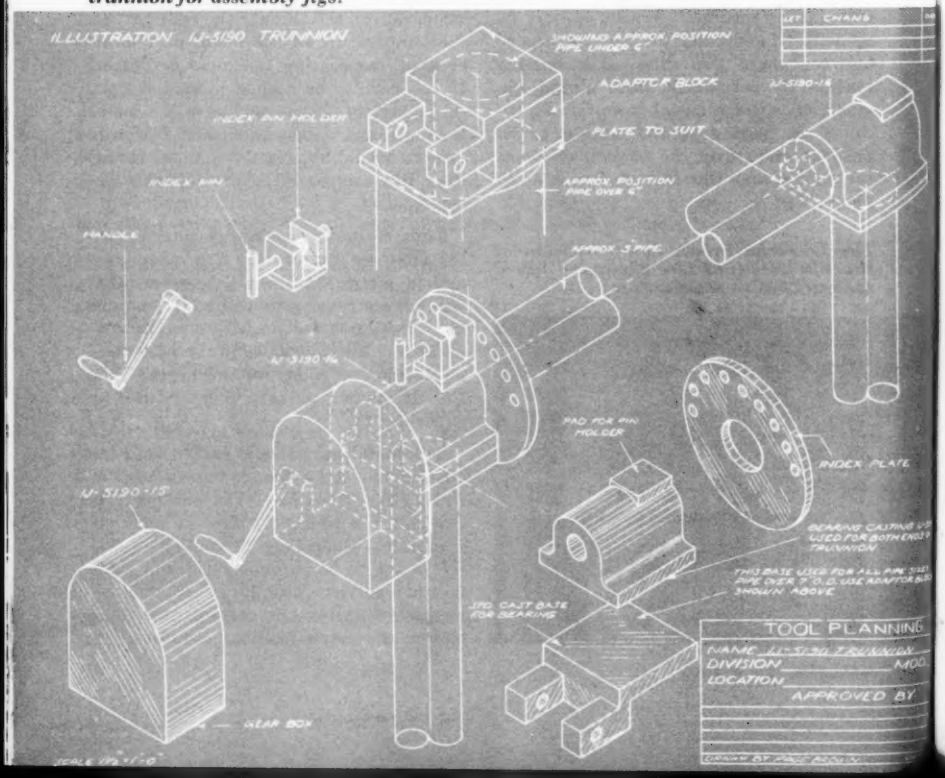
Because accessibility is one of the most important features of any assembly tool, one of the greatest problems involved in the design and construction of the larger jigs or fixtures is the matter of acquiring a workable indexing mechanism, which will permit operators to vary the position of the work so that it will be within easy reach at all times.

Accompanying illustrations indicate the design of a trunnion which has satisfactorily solved this problem in connection with most of the assembly fixtures which are currently being used by Consolidated Vultee Aircraft Corporation.

It is a screw-type mechanism which will permit the locating members of a jig to be rotated 180 degrees without difficulty. An index plate and a spring-actuated pin stop make it possible to position the work at any convenient angle in the plane of rotation.

All parts of the mechanism are steel, and do not have to be machined to extremely close tolerances.

This drawing indicates essential parts of Consolidated Vultee Aircraft Corporation's trunnion for assembly jigs.

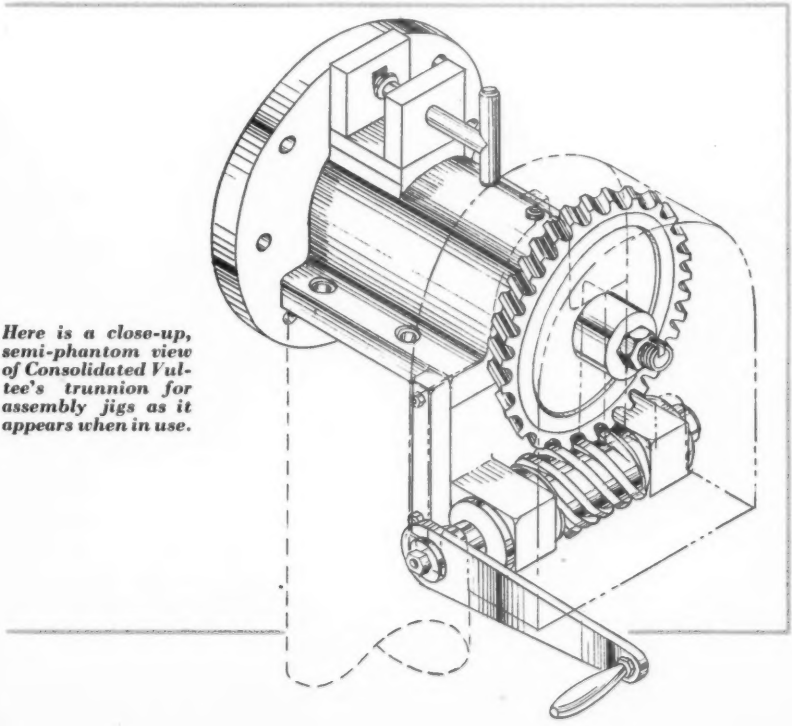


Shown here is a torque-beam assembly fixture with a trunnion-actuated indexing mechanism, which is capable of turning the work to any desired angle of accessibility.

by Thomas A. Dickinson

Fittings on the trunnion illustrated were made for use in connection with oil-well casing structural members. However, they could be readily altered for use in connection with other types of structures.

The screw-type gearing is desirable in most cases, because it is economical and can be readily operated by a single worker; but it can be replaced by hydraulic actuating cylinders when extremely large jigs and delicate work must be handled.



Here is a close-up, semi-phantom view of Consolidated Vultee's trunnion for assembly jigs as it appears when in use.

The Brehm Trim ("Shimmy") Die

When trimming shells drawn from flat sheet metal there are several methods that might be used. If perfectly flat, straight edges are desired with uniform depth and edges free from burrs, the Brehm Trim Die should be considered. This die will trim the entire edge of most shells in one press stroke using a shear action similar to a blanking die. In some types of shells, notches or projections can be obtained when trimming.

Dies of this type have been used for a number of years in trimming shells varying from parts for ladies' wrist watch cases to electric refrigerator doors. Practically all kinds of metals have been cut varying from .008 brass to .218 steel.

Referring to Figure 2, the punch "J" has the same contour and size as the inside of the shell at the point where the shell is to be trimmed. The die cutting member "M" has an opening to fit the outside of the shell at the trim line. The depth of the trimmed shell is determined by the gage member "L" which is movably attached to the punch. The shell ejector "Q" holds the shell against the gage member during the trimming operation.

When the die is in operation the gage member "L" descends, pressing the shell against the spring actuated ejector "Q" forcing it down until a series of studs "K" contact the die plate "M". Then both punch and die move downward in unison during the remainder of work portion of the stroke. During this downward travel of "M" and its supporting member "P", a series of cams at different elevations on the sides of "P" function with cams "S" of uniform height, converting the downward travel of "M" and "P" into a series of horizontal movements toward the punch, shearing away a portion of the scrap on each horizontal movement.

Figure 1 shows the die open for the insertion of the untrimmed shell and the removal of the trimmed part and the scrap. "A" represents the required travel of the die during the trimming action. "B" shows the extent a die must open if "C" equals the depth of the trimmed shell and "D" equals the height of the untrimmed shell plus loading clearance. "E" shows the relative position of the first set of cams that will function when the die is in use.

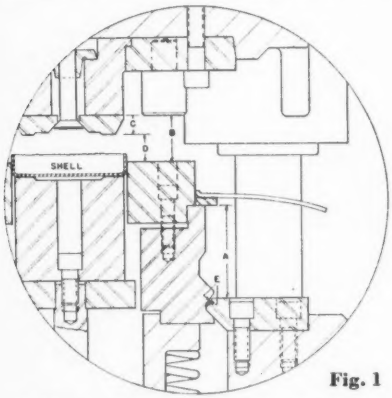


Fig. 1

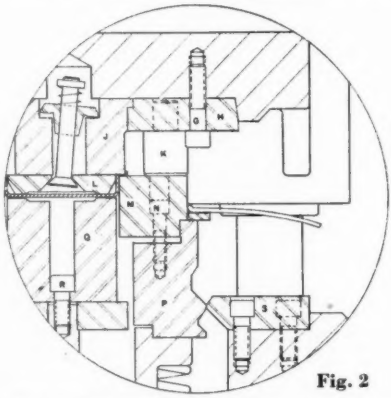


Fig. 2

One of the essential features required to obtain trimmed edges without burrs by a shearing action is a definite cutting clearance between the cutting edges. On Brehm Trim Dies this clearance is obtained by surface grinding the face of the punch "J" shorter than the studs "K".

All Brehm dies are built so that the

Figure 3

cutting adapters can easily be removed and others inserted to trim various size shells. Each shell of different size or shape will require the punch adapters consisting of parts "H", "J", "K" and "L", the die cutting member "M" and the ejector "Q" of Figure 2. Shells of the same diameter or shape but of different depths can be trimmed with the same cutting members but different lengths of gage members are required.

Figure 3 shows the conventional design of Brehm dies in both 2″ and 5″ size, each equipped with a second set of cutting adapters. The designated size of a die represents the greatest diameter of round shell the die will trim. Shapes other than round can also be trimmed in any given die size if trimmed outline is within a circle equal to rated die size.

The horizontal movement of a die is determined by the gauge of metal for which the die is built to cut. This movement is fixed but does not prevent using the die to trim a shell of lesser gauge metal. The movements of the die cutting members on conventional dies are suitable to trim straight edges or edges with notches or projections.

All parts shown in Figure 4 were completely trimmed in conventional dies except No. 12. This required a special six-sided cam block which had three horizontal cutting movements at 120°.

Shell No. 1 is of .187 steel.

Shells Nos. 4, 8 and 14 were notched when trimmed.

Shells Nos. 3 and 13 have angular edges.

Shell No. 11 has a curved edge.

Shells Nos. 2, 5 and 10 have edges trimmed parallel to their bottoms or at right angle to the surface of the shell at the trim line.

Shell No. 6 is of .016 stainless steel trimmed about the formed end.

Production from these dies will vary from 500 to 700 per hour when the trimmed shell and scrap are removed by the operator. Using air operated ejectors to raise the trimmed parts to the top of the die and blowing them from the die has given productions from 900 to 1200 per hour according to the size of the shell. Clover leaf shaped shells measuring 11″ across the trimmed edges were run at the rate of 10,000 per eight hour shift, in line production during the war.

Figure 4

Patents and Rights to Inventions

by H. S. Silver
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The comic strip standard selling price for a patent is $1,000,000. Assuming the average cost of obtaining a patent to be $500, this would represent a 2,000 to 1 return on the original investment. Few patents have been worth a million dollars, and a great percentage of the approximately 2,400,000 patents issued by the United States Patent Office have failed to provide a monetary return sufficient to defray the cost of obtaining the patent.

An invention often is made during the solution of a problem and starts with an idea for doing something new or doing something old in a new way, often without the inventor realizing that invention is involved. If and when the inventor realizes that he may have made an invention, the possibility of obtaining patent or other protection interests him.

Economics is a first consideration in determining the desirability of patent protection. Again assuming the cost of obtaining a patent to be $500, will the right to exclude others from using the invention be worth $500? The correct answer to this question involves consideration of the extent of the use of the invention during the possible protection period; that is, whether a great many or only a few uses would be made. A further consideration involves the necessity and cost of development of the invention so that it may be commercially successful and the ancillary question of necessity of development of a market. Another consideration involves the question of other ways of doing the same job—that is, whether there are other solutions for the problem; and if so, does this invention solve the problem in a cheaper, quicker, or better manner?

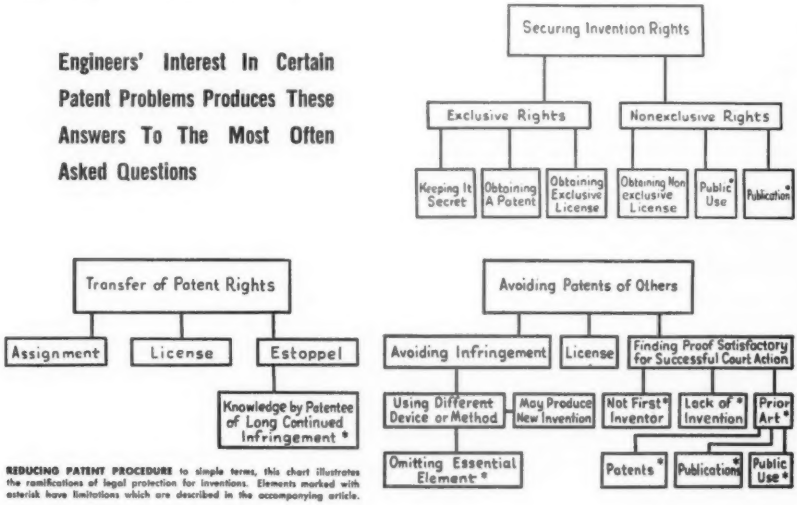
Exclusive Rights to Inventions

If the answers to the above questions lead to the decision that exclusive rights to the invention are worth more than the patent cost, steps should be taken to maintain these exclusive rights. Although the value of preventing others from using the invention may not seem to be worth the patent cost, patent protection may still be desirable. The inventor may desire to establish his right to use his invention independently of any patent that another might obtain on a similar invention.

One method of maintaining exclusive rights to an invention is to keep the invention secret, the prevention of others from making or using the invention resulting from their lack of "know-how". However, this method is seldom effective for more than a very short period of time, and if and when someone else discovers the secret, the exclusive rights vanish.

The better and more usual method of providing exclusive rights is to obtain patent protection. First step in obtaining patent protection is to record the conception of the invention, preferably by writing a description of the device and its operation, illustrated by sketches if helpful, and by disclosing the invention to others. The description and the sketches should be signed, dated and witnessed, with the date of witnessing. And the next desirable step is to diligently complete the invention. Completing the invention, in the technical patent sense, is effected by reducing the invention to practice, and actual reduction to practice is effected by embodying the invention in a full size device and operating it successfully under conditions similar to those to which it would normally be subjected. The filing of a patent application including patentable subject matter is considered a constructive reduction to practice.

Engineers' Interest In Certain Patent Problems Produces These Answers To The Most Often Asked Questions



REDUCING PATENT PROCEDURE to simple terms, this chart illustrates the ramifications of legal protection for inventions. Elements marked with asterisk have limitations which are described in the accompanying article.

Patent Application Procedure

At any time after conception of the invention, the inventor will probably desire to consult his patent attorney. Few inventors have the technical knowledge necessary for the skillful preparation of a patent application, and unless the application is skillfully prepared the resulting patent may well lose some or all of its potential commercial value.

Before a patent application is filed, the patent attorney may make a search of the art to determine whether similar devices have been disclosed in previously granted patents or other publications, in order to determine whether the probable claims obtainable are worth the cost of the patent. The prior art also serves as a guide in drawing the patent claims.

After the patent application is filed, it is usually left in the hands of the attorney who prosecutes the application in the Patent Office until a patent is issued, or other final action given. If a patent issues, the inventor is granted exclusive rights for a period of 17 years beginning with the date the patent issues. A United States patent gives the inventor exclusive rights only for manufacture, use, and sale in the United States. If exclusive rights in other countries are desired, it is necessary to file patent applications in those countries also.

A valid patent can be obtained only if the patent application is filed within one year (two years for patent applications filed prior to August 5, 1940) from the date on which the invention was on sale, was put into public use or described in a patent or printed publication.

A valid patent can be obtained only by the "first" inventor. When two or more individuals independently conceive and complete the same invention, it is necessary to determine which one was "first". The first to *complete* the invention is *presumed* to be the first inventor. However, the matter of diligence between conception of the invention and its reduction to practice or completion may affect this presumption.

If a man who first conceived an invention stopped work on it for a period of time before completion and resumed work only after a later conceiver had completed the same invention, the later man may be determined in an interference proceeding in the Patent Office to be the "first" inventor so far as the right to a patent is concerned. If the first man could prove diligence in working toward completion of his invention, from a time just prior to the time the second man entered the field until completion of his (the first man's) invention, the first man would be determined to be the "first" inventor, unless he had abandoned his invention.

The issuance of the patent to an inventor gives him no further right, other than he then has, to use his invention. His right to make, use and sell his invention may be limited by prior patents issued to others. The issuance of a patent is no guarantee as to the validity of the claims therein, but the burden of proof is on one who disputes their validity. In other words, the claims of an issued patent are presumed to be valid until proved invalid. The claims of a patent appear in numbered paragraphs describing the forbidden ground on which others may not tread.

A patent owner may transfer rights to his patent by assignment or by granting the exclusive license with a right to sue for past infringement. After such assignment or exclusive license, his rights to make, use or sell apparatus embodying the invention are no greater than those of any other outsider. However, by granting a non-exclusive license, he gives up his right to prevent the licensee from manufacturing, using or selling the device covered by the patent. Such non-exclusive license may be limited to include only a particular class of devices or may be limited territorially. A patent owner may forfeit his right to recover from an infringer by knowingly permitting long-continued infringement of the patent by such infringer, without taking effective action toward stopping it.

Non-exclusive Rights to Inventions

Without filing a patent application an inventor may perpetuate the right which he then has to make, use and sell his invention by the doing of some act which will bar others from obtaining a valid patent for such invention. This may be accomplished by either of the following:

1. *Public Use*—If the invention is embodied in one or more installations in public use for one year before another files a patent application for such invention, no valid patent can be obtained, and hence such public use would preserve the non-exclusive right which the inventor has to make, use or sell his invention. Of course, such rights being non-exclusive, other persons may similarly make, use, and sell such invention.

2. *Publication*—If the work of em-

bodying the invention in a public use is too great or costly, the same type of protection, as set forth in (1) above, can be obtained by publishing a disclosure of the invention. Such a publication more than one year prior to filing of a patent application would bar the grant of a valid patent for the invention. This published disclosure must be sufficiently clear and complete so that anyone skilled in the art could make and use the invention. The publication must be a printed one and must be available to the public. In this connection, a publication by a manufacturer for distribution only within his own organization would not bar another inventor from obtaining a valid patent for the invention.

A situation sometimes arises in which one desires to use a structure which effects the same result as obtained by a patented invention, but to do so, without license, would invite a suit for infringement. In such cases, there are several courses open. One of the best ways out of this difficulty is to find a different way of doing the same thing; that is, a way which does not utilize the invention covered by the patent claim. Inventions are often made in this manner. The saying "Necessity is the mother of invention" applies. By the exercise of ingenuity, it is often possible to obtain the desired result in a different or better manner. On the other hand, often an older and patentably free device may be found to be equally good or to serve the purpose better.

Avoiding Patent Claims

In the process of finding different ways to produce a given result, the principle of inversion is sometimes useful, particularly where the resulting effects afford superior advantages. This consists of inverting and interchanging elements of the patented device so that, for example, the moving parts of the patented device become the stationary parts of the modified device and vice versa. It is sometimes possible through this procedure to make a new invention.

Another method of avoiding a patented invention is to design a device that does not include all of the essential elements of the invention covered by the patent claims. In many cases, patent claims have been limited in order to avoid the prior art, and, therefore, avoidance is not too difficult. It is necessary to exclude but one *essential* element of a claimed invention in order to avoid infringement of the claim. An element is not omitted if an equivalent element is substituted in its place. For example, if the patented invention covers the use of copper for the construction of a device and it could be equally well produced in steel, zinc, or any other metal, the invention could not ordinarily be avoided merely by constructing the device of one of the other metals. However, if the use of copper was specifically stated to be part of the invention because it had peculiar properties which rendered the device operative in a particular desired manner not provided by other metals, it might be possible to avoid the patent claims by use of some metal which the art had therefore considered unsatisfactory.

In other words, the inventor is entitled to reasonable latitude, in construing his invention, in the matter of equivalents which could be substituted by anyone skilled in the art for the elements of the claimed invention.

Patent claims can be avoided by discovering prior constructions put into public use, or regarding which a disclosure has been published, more than one year (two years if the application was filed before August 5, 1940) prior to the filing date of the application for the patent involved. The usual evidences of such prior art are printed publications, foreign or domestic patents, or the records of manufacturers or others showing public use of the patented device. Such prior publications, patents or public use would bar recovery for infringement even though the claims of the patent are readable on the device used. Sometimes, claims are drawn broadly enough to read on prior art which did not come to the attention of the patent examiner. The inadvertent issuing of the patent did not take away anyone's right to use the prior art, although such patent may well worry those ignorant of the prior art.

It sometimes happens that patents are issued claiming as inventions a summation of old elements, each merely adding in its own particular function and providing no different cooperation of this element in the combination over that which could be properly expected by placing them together. In such cases, where no such new or unexpected result is obtained, the claims may be held invalid because of lack of invention. This is often very difficult to prove because results seem obvious after someone has shown how to obtain them. A would-be infringer is often prejudiced in his consideration of the matter. It is very difficult to prove that a patented invention should have been obvious to others, when in fact it was not obvious to those skilled in the art for a considerable period while the problem was present.

Since the patent cannot be held valid unless it is issued to the "first" inventor, if one can prove that the patentee was not the "first" inventor, he has a good defense to an infringement charge. In this connection, if it can be proved that the man named as inventor in a patent is not in fact the inventor, the patent can be held invalid by a court. For example, a man may have been wrongfully included as one of two joint inventors merely because he was in a position of authority over the true inventor, or a man may have contributed only suggestions or advice as to minor features not essential to completion of the real invention. In such a situation, the real inventor may well lose his right to the protection seemingly given by the patent.

If one claim of the patent is anticipated by the prior art, that claim may be held invalid by a court. However, other claims of the patent which are not held invalid may be saved by a proper disclaimer of the invalid claims. Where one believes that claims of a patent would be held invalid if a suit were instituted, it is not usual to notify the patentee of such belief, but to proceed to use the desired construction, relying on a defense of invalidity in any suit for infringement of such claims.

Securing Patent License

It must be remembered that although one believes that he can make a successful defense in a patent suit, still it costs money and time, and you may lose. The safest way to avoid trouble is to avoid using the *invention* of a patent, and if you can't avoid the invention, obtain a license.

A patent license may grant either the exclusive or a non-exclusive right to make, use and sell a device. The license may cover making and using, making and selling, or all three. The license may be given free or for a fixed sum royalty, or a royalty based on the number of units sold, or the selling price of the units, or for a consideration including rights to use other patents, or for any other legal consideration. When a patented device is sold by the patentee or his licensee, it carries with it an implied license for resale or for use for the purposes for which that device is ordinarily used, unless the sales agreement contains provisions to the contrary. For example, a special radio tube which would be used only in one particular type of circuit, if sold by the holder of the patent of that particular type of circuit, would carry with it an implied license for use of such circuit. If, however, the radio tube has other recognized uses, such sale would carry with it no implied license to make, use and sell any particular patented circuit.

Admission of Validity

If a license is granted under a patent, the licensee is ordinarily presumed, in a suit for royalty under the license contract, to admit the validity of the patent claims under which royalty is payable.

This legal fiction is similar to that in landlord and tenant law, where in a suit for rent the lessee is estopped from proving that the landlord does not have good title to the rented property. Therefore, while the patent license is in force, the defense of invalidity is not open to the licensee in any suit for royalty under the contract, and the agreed royalty is to be paid independently of whether one has discovered evidence that may prove some of the claims invalid.

TDJ SHOP DATA SHEET NO. 32

Method of Determining the Length of a Bend

In production work involving the use of bent shapes of pipe, tubing, or sheet metal, the problem of cutting these materials to the correct length before bending is of the greatest importance. When pipe, tubing, or sheet metal is bent through a given angle to a specified radius, a definite amount of length is taken up in the bend. This amount must be added to the straight length sections in order to arrive at the required total length of the material to be cut off.

For all practical purposes the length of a curved section is assumed to be equal to the length of arc subtended by the angle of the bend and is measured along the centerline of the material at the radius of the bend.

The length of arc is a fixed quantity for each radius and each angle of bend and can be computed when these factors are known. The total length of any piece which has one or more bends is equal to the sum of all the straight lengths plus the length of each bend.

The accompanying table gives the length of arc at unit radius for angles from 1° up to 180°. This length of arc is a constant and is designated as "K". K is derived in the following manner:

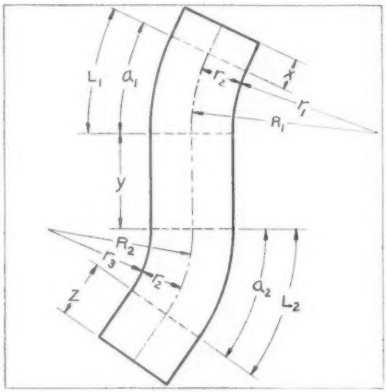
Circumference of a circle $= \pi D = 2\pi r$, where D = diameter and r = radius.

Arc of a circle $= \frac{2\pi ra}{360}$, where a = angle in degrees.

Since r and a are variables, then $\frac{2\pi}{360}$ is the constant, K, and = .01745 when a = 1.

To find the length of a bend, when the radius of the bend and the angle of the bend are known, multiply the value of K, given in the accompanying table, opposite the angle of bend by the bending radius measured to the centerline of the material. The radius of bend is equal to the sum of the radius of the radius block plus the radius of the pipe, tubing or half thickness of sheet metal; that is,

If R = Bending Radius
r_1 = Radius of radius block
r_2 = Radius of pipe or tube
t = Thickness of sheet metal
Then $R = r_1 + r_2$, or
$R = r_1 + \frac{1}{2}t$
Length L of the bent portion is,
$L = R \times K$



EXAMPLE, To determine total length of tubing necessary to meet the specifications in the accompanying sketch, when $r_1 = 3''$; $r_2 = \frac{3}{4}''$; $a_1 = 25°$; $a_2 = 35°$; $r_3 = 2''$; $x = 4''$; $y = 7''$; $z = 6''$
$R_1 = r_1 + r_3 = 3'' + \frac{3}{4}'' = 3\frac{3}{4}''$
$R_2 = r_3 + r_2 = 2'' + \frac{3}{4}'' = 2\frac{3}{4}''$
K for 25° = .43633
K for 35° = .61086
$L_1 = R_1 \times K$ for 25° $= 3\frac{3}{4}'' \times .43633$
$= 1.636$
$L_2 = R_2 \times K$ for 35° $= 2\frac{3}{4}'' \times .61086$
$= 1.680$
Total length of tube
$= x + L_1 + y + L_2 + z$
$= 4 + 1.636 + 7 + 1.680 + 6$
$= 20.316$

Table of Constant "K"

Angle in Degrees	Constant K	Angle in Degrees	Constant K	Angle in Degrees	Constant K	Angle in Degrees	Constant K
1	.01745	46	.80285	91	1.58825	136	2.37364
2	.03490	47	.82030	92	1.60570	137	2.39110
3	.05236	48	.83775	93	1.62315	138	2.40855
4	.06981	49	.85521	94	1.64060	139	2.42600
5	.08726	50	.87266	95	1.65806	140	2.44346
6	.10472	51	.89011	96	1.67551	141	2.46091
7	.12217	52	.90757	97	1.69296	142	2.47836
8	.13962	53	.92502	98	1.71042	143	2.49582
9	.15708	54	.94247	99	1.72787	144	2.51327
10	.17453	55	.95993	100	1.74532	145	2.53072
11	.19198	56	.97738	101	1.76278	146	2.54818
12	.20944	57	.99483	102	1.78023	147	2.56563
13	.22689	58	1.01229	103	1.79768	148	2.58308
14	.24434	59	1.02974	104	1.81514	149	2.60054
15	.26179	60	1.04719	105	1.83259	150	2.61799
16	.27925	61	1.06465	106	1.85004	151	2.63544
17	.29670	62	1.08210	107	1.86750	152	2.65290
18	.31416	63	1.09955	108	1.88495	153	2.67035
19	.33161	64	1.11701	109	1.90240	154	2.68780
20	.34906	65	1.13446	110	1.91986	155	2.70526
21	.36651	66	1.15191	111	1.93731	156	2.72271
22	.38397	67	1.16937	112	1.95476	157	2.74016
23	.40142	68	1.18682	113	1.97222	158	2.75762
24	.41887	69	1.20427	114	1.98967	159	2.77507
25	.43633	70	1.22173	115	2.00712	160	2.79252
26	.45378	71	1.23918	116	2.02458	161	2.80998
27	.47123	72	1.25663	117	2.04203	162	2.82743
28	.48869	73	1.27409	118	2.05948	163	2.84488
29	.50614	74	1.29154	119	2.07694	164	2.86234
30	.52359	75	1.30899	120	2.09439	165	2.87979
31	.54105	76	1.32645	121	2.11184	166	2.89724
32	.55850	77	1.34390	122	2.12930	167	2.91470
33	.57595	78	1.36135	123	2.14675	168	2.93215
34	.59341	79	1.37881	124	2.16420	169	2.94960
35	.61086	80	1.39626	125	2.18166	170	2.96706
36	.62831	81	1.41371	126	2.19911	171	2.98451
37	.64577	82	1.43117	127	2.21656	172	3.00196
38	.66322	83	1.44862	128	2.23402	173	3.01942
39	.68067	84	1.46607	129	2.25147	174	3.03687
40	.69813	85	1.48353	130	2.26892	175	3.05432
41	.71558	86	1.50098	131	2.28638	176	3.07177
42	.73303	87	1.51843	132	2.30383	177	3.08923
43	.75049	88	1.53589	133	2.32128	178	3.10668
44	.76794	89	1.55334	134	2.33874	179	3.12413
45	.78539	90	1.57079	135	2.35619	180	3.1416

TDJ SHOP DATA SHEET NO. 33

Cutting Fluids for Drilling

MATERIAL	CUTTING FLUID	
	Order of Decreasing Effectiveness	Order of Increasing Expense
Aluminum & Alloys	Kerosene Kerosene & Lard Oil Soda Water	Soda Water Kerosene Kerosene & Lard Oil
Brass	Dry Kerosene & Min. Lard Oil (Deep Holes) Soda Water (Deep Holes)	Dry Soda Water Kerosene & Mineral Lard Oil
Magnesium & Alloys Bronze	Mineral Lard Oil Soda Water Dry	Dry Soda Water Mineral Lard Oil
Copper	Mineral Lard Oil & Kerosene Soda Water Dry	Dry Soda Water Mineral Lard Oil & Kerosene
Monel Metal Mild Steels Tough Alloy Steels Steel Forgings Cast Steel Wrought Iron	Mineral Lard Oil Sulphurized Oil Soda Water	Soda Water Mineral Lard Oil Sulphurized Oil
Manganese Steel Cast Iron	Dry	Dry
Malleable Iron	Dry Soda Water (Deep Holes)	Dry Soda Water
Tool Steel	Mineral Lard Oil & Kerosene Kerosene Mineral Lard Oil	Mineral Lard Oil Mineral Lard Oil & Kerosene Kerosene
Micarta, Bakelite Fiber, Asbestos, Hard Rubber, Ebony	Dry	Dry

From material prepared by, and furnished through courtesy of, Westinghouse Electric Corporation.

TDJ SHOP DATA SHEET NO. 34

Cutting Fluids for Machine Reaming • Cutting Fluids for Tapping

Material	Cutting Fluid
Aluminum & Alloys Magnesium & Alloys	Mineral Lard Oil Kerosene Soda Water
Brass and Bronze	Soda Water
Cast Iron	Dry
Cast Steel	Lard Oil Mineral Lard Oil Soda Water
Copper	Lard Oil Soda Water
Malleable Iron	Soda Water Mineral Lard Oil
Monel Metal	Lard Oil Soda Water
Mild Steel	Mineral Lard Oil Soda Water
Tough Alloy Steels Steel Forgings	Mineral Lard Oil Sulphurized Oil Soda Water
Steel, Tool	Lard Oil Sulphurized Oil Soda Water
Wrought Iron	Mineral Lard Oil Soda Water
Micarta & Bakelite	Mineral Lard Oil

Material	Cutting Compound
Aluminum Alloys	½ Lard Oil & ½ Kerosene
Magnesium Alloys	Light Mineral Oil
Brass and Bronze	Light Mineral Oil Dry
Cast Iron	Small Amounts of Mineral Lard Oil, Soap, or Tallow
Copper	*"Cresol z-3" & Paraffin Oil No. 3313-4 & Paraffin Oil
Malleable Iron	Sulphurized Oil
Monel Metal	Lard Oil & Kerosene Sulphurized Oil
Wrought Iron Mild Steel	No. 3313-4 & Paraffin Oil
Tool Steel	Sulphurized Oil Lard Oil & Kerosene
Stainless Steel	Sulphurized Oil
Tough Alloy Steels Cast Steel Steel Forgings	Sulphurized Oil
Rubber, Hard Fiber	Dry
Micarta, Moldarta & Other Molded Plastics	Dry

*"Cresol z-3" is an excellent heat dissipator and does not stain the work. It is rather expensive but may be used in a 10% solution of Paraffin Oil.

From material prepared by, and furnished through courtesy of, Westinghouse Electric Corporation.

TDJ SHOP DATA SHEET NO. 35

Approximate Blank Diameters for Drawn Shells (inches)

SHELL DIAM. (inches)	DEPTH OF DRAW (inches)					
	1.250	1.375	1.500	1.625	1.750	1.875
3.125	5.04	5.19	5.34	5.48	5.63	5.76
3.250	5.18	5.33	5.48	5.63	5.77	5.91
3.375	5.31	5.47	5.62	5.77	5.92	6.05
3.500	5.45	5.61	5.77	5.91	6.06	6.20
3.625	5.59	5.75	5.90	6.06	6.21	6.35
3.750	5.73	5.89	6.04	6.20	6.35	6.49
3.875	5.86	6.02	6.18	6.34	6.49	6.64
4.000	6.00	6.16	6.32	6.48	6.63	6.78
4.125	6.13	6.30	6.46	6.62	6.77	6.92
4.250	6.27	6.43	6.60	6.76	6.91	7.06
4.375	6.40	6.57	6.73	6.89	7.05	7.21
4.500	6.53	6.70	6.87	7.03	7.19	7.35
4.625	6.67	6.84	7.01	7.17	7.33	7.48
4.750	6.80	6.97	7.14	7.31	7.47	7.62
4.875	6.93	7.11	7.28	7.44	7.60	7.76
5.000	7 07	7.24	7.41	7.58	7.74	7.90
5.125	7.20	7.37	7.55	7.72	7 88	8.04
5.250	7.33	7.51	7.68	7.85	8.02	8.18
5.375	7.46	7.64	7.82	7.99	8.15	8.31
5.500	7.60	7.77	7.95	8.12	8.29	8.45
5.625	7.73	7.91	8.08	8 25	8 42	8.59
5.750	7.86	8.04	8.22	8.39	8.56	8.72
5.875	7.99	8.17	8.35	8.52	8.69	8.86
6.000	8.12	8.30	8.48	8.66	8.83	9.00

TDJ SHOP DATA SHEET NO. 36

Approximate Blank Diameters for Drawn Shells (inches)

SHELL DIAM. (inches)	DEPTH OF DRAW (inches)					
	2.000	2.250	2.500	2.750	3.000	3.250
3.125	5.90	6.16	6.40	6.64	6.87	7.10
3.250	6.05	6.31	6.56	6.80	7.04	7.26
3.375	6.19	6.47	6.72	6.96	7.20	7.43
3.500	6.35	6.61	6.87	7.12	7.37	7.60
3.625	6.49	6.76	7.03	7.28	7.52	7.76
3.750	6.63	6.91	7.18	7.43	7.68	7.92
3.875	6.78	7.06	7.33	7.59	7.84	8.08
4.000	6.92	7.21	7.48	7.74	8.00	8.24
4 125	7.07	7.36	7.63	7.89	8.15	8.40
4.250	7 21	7.50	7.78	8.05	8.31	8.56
4.375	7.35	7.64	7.93	8.20	8.46	8.71
4.500	7.50	7.79	8.07	8.35	8.61	8 87
4.625	7.64	7.93	8.22	8.50	8.76	9.02
4.750	7.78	8.08	8.37	8.64	8.91	9.18
4.875	7.92	8 22	8.51	8.79	9.06	9.33
5.000	8.06	8.36	8.66	8.94	9.21	9.48
5.125	8.21	8.51	8.80	9.09	9.37	9.63
5.250	8.34	8.65	8.94	9.23	9.51	9.78
5.375	8.48	8.79	9.09	9.38	9.66	9.93
5.500	8.61	8.93	9.23	9.52	9.81	10.08
5.625	8.75	9.07	9.37	9.67	9.95	10.23
5.750	8 89	9.20	9.51	9 81	10.10	10.38
5.875	9 02	9.34	9.65	9.95	10.24	10 52
6.000	9.16	9.48	9.79	10.09	10.39	10.67

Elimination of Vibration in Machine Tools*

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Vibration Chatter Marks

Chatter marks found on finely finished surfaces can be caused by three kinds of vibration; forced, shock, and self-excited. Forced vibrations are initiated by the sources of power such as; motors and pumps, unbalanced rotating parts, ball and roller bearings, gears and any mechanism which transfers energy in uniformly timed impulses. Shock vibrations are the results of acceleration or deceleration of masses, such as the table. Shock also originates externally from passing trains, stamping machines, and hammers. Self-excited vibration is present in many metal cutting operations to some degree. Slowly moving tables and slides are often a source of self-excited or relaxation oscillations.

Significance of Chatter

What is the significance of chatter? The average contour is not changed by chatter and boundary friction has not been found to change appreciably. Dayton's work indicates that initial run-in should be improved by chatter marks. Measurements to an accuracy of one ten-thousandth of an inch are unaffected. However, the appearance is certainly altered, making visual inspection more uncertain. Where surfaces are to be inspected with optical flats, chatter marks are confusing. A ring gage will appear spotted, or banded after using a few times with chatter marks only a few millionths deep. During the war measuring instruments with an accuracy of five millionths of an inch were used but chatter marks with a depth of only a few millionths made measurement uncertain. Chattering reduces the life of single point tools, and harder grinding wheels are required on a rough than on a smooth machine. Workmen exercise greater care in handling nicely finished work, resulting in less spoilage.

Elements of Vibration

A review of some of the major elements of mechanical vibration seem appropriate at this point. A single degree of freedom system is a spring supporting a mass as shown in Figure 2. When this is excited by a sinusoidal force of constant magnitude and gradually increasing frequency, the motion will be in phase with the force and of increasing amplitude until resonance is reached. Then the amplitude will be limited by the damping of the system primarily the internal loss of the spring. Increasing the frequency further, the amplitude will decrease and approach zero while the phase will have reversed, i.e., the motion will be in opposition to the force. If a second mass is suspended by a spring from the first mass, a two de-

*From a paper presented at the Machine Tool Forum held at Westinghouse Electric Corporation, Pittsburgh, Pennsylvania, April 9 and 10, 1946.

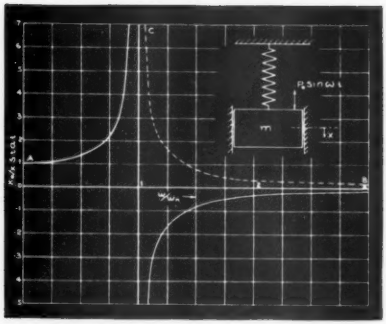
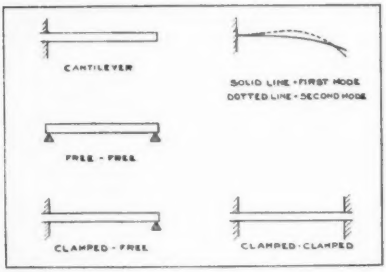


Fig. 2. A spring and supporting mass illustrating a system having a single degree of freedom.

gree of freedom system results. Then there will be two resonant points and the phase relations are rather difficult to describe.

Consider next a cantilever, a free-free

Fig. 1. Four types of beams; a cantilever, a free-free, a free-clamped, and a clamped-clamped beam.



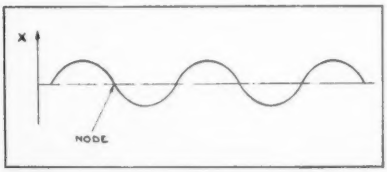


Fig. 3. Sine wave for sinusoidal force of constant magnitude and frequency.

beam, a free-clamped beam or a clamped-clamped beam as shown in Figure 1. When similarly excited each of these will have a first mode of vibration, a second mode about six and one-half times the frequency of the first mode, a third mode about twenty-two times the frequency of the first mode and so on indefinitely. Thus a beam has an infinite number of degrees of freedom.

When one of these bars is vibrating, and if the amplitude along its length is measured as shown in Figure 3, it will be seen that there are points of zero amplitude called nodes, separating regions of high amplitude. Furthermore, alternate regions reverse in phase. So, if a sinusoidal force of constant magnitude and variable frequency is applied, the amplitude, phase, and the number and position of the nodes will vary.

The foregoing is not too hard to understand and figure out, but if weights are added to the beam, and if one or more of these periodically changes position, analysis would be difficult. The simplest solution then would be measurement of a full sized model.

This is a fair description of a machine tool if a beam of variable section is substituted. It is interesting to note that this is approximately equivalent to an electrical transmission line with distributed and concentrated constants, the resistance corresponding to damping, the induction to mass, the capacitance to the spring constant, the conductance to the contacts made with the floor, and the branch distribution lines to bridges, table and cross slide. See Figure 6.

Consider the uniform beam again. If a sinusoidal force of constant amplitude and frequency is applied and is slowly moved along the beam, and if this frequency corresponds to one of the natural nodes of vibration of the beam, the resulting vibration will be maximum when the application is midway between the nodes and minimum when applied at the nodes. In an internal grinder this corresponds to the wheelhead and motor moving along the base ways. Thus the amplitude of vibration of the base varies and excites the bridge and workhead in a pulsating manner for long work. And where the table stroke is short the amplitude will depend on the particular

location of the table when grinding, i.e., at which point on the base the excitation is applied.

Tool and Work Vibrations

It becomes evident that the tool and the work, under the influence of a common excitation, will vibrate at the same frequency but each with its own amplitude and phase. If the phase and amplitude are identical, no relative motion will result. However, any other values will produce relative motion that leave chatter marks on the work surface. By the principle of superposition, each forced frequency will act independently producing its own chatter, often making trouble shooting difficult.

The above tacitly assumes forced vibrations only were involved. Self-excited vibration resulting from the cutting operation will produce exaggerated chatter and will react upon the whole machine exactly the same as any other source of pulsating energy.

Shock Vibration

Shock vibration may be internal or external. The ideal method of mounting to guard against external shock is a soft mounting under the base. But since most machines are not self supporting, a heavy sub base is required. Practically, shock pads are made stiff enough so all the forced vibrations in the machine are below the resonance frequency of the mounting.

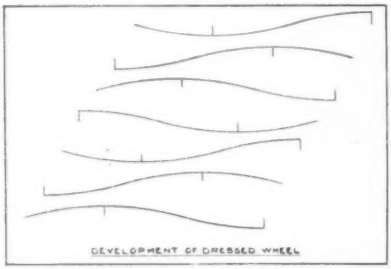
Internal shocks cannot be isolated. When they occur, each part of the machine acts as though struck by a hammer and vibrates at its natural frequency, gradually reducing in magnitude at a rate dependent on the damping. Chatter is invariably produced in this case, its depth a function of the impact.

It is interesting to note that a rough belt produces an irregular series of shocks or repeated transients. These excite the spindle resulting in a most confusing type of chatter, often not recognized as such.

Pulsation Energy

The best solution for chatter produced by forced vibrations is to do away with the cause. Some progress has been made

Fig. 4. Development of dressed wheel.



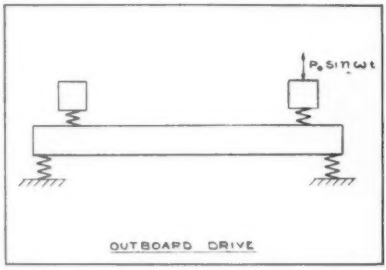
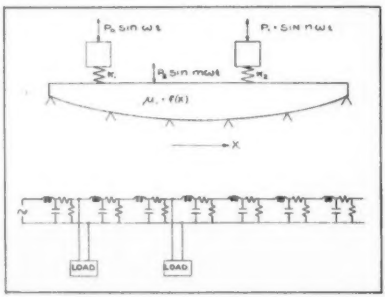


Fig. 5. Outboard drive.

in this direction with induction motors and pumps. Induction motors have three major sources of pulsating energy; rotational unbalance, ball bearings, and the rotating magnetic field. Rotational unbalance is easily corrected, precision bearings reduce this source to an acceptable value, but the magnetic prob-

(CONTINUED ON PAGE 125)

Fig. 6. Electrical analogy of involved mechanical system.



Patent Survey Committee Objectives

The independent inventor, who in the past has been responsible for most of the nation's great inventions, is rapidly becoming outmoded and his place is being taken by trained workers in organized research laboratories whose patents for the most part are owned by the corporations they work for, according to W. Houston Kenyon, Jr., Counsel for the Patent Survey Committee, Department of Commerce.

As a result of this and other changes the American patent system has recently come under considerable criticism, and it is in response to this criticism that the Patent Survey Committee, appointed at the direction of President Harry S. Truman, is making a study preliminary to making recommendations as to how the patent system can be made better suited to modern conditions.

As a result of the work so far done the problems that must be answered by the Committee are becoming clearer, Mr. Kenyon disclosed, and some of them can now be stated, at least in their broad outline.

In general, he said, the critics of the patent system assert that technical men employed by corporations as members of a research team are slaves to the policy of corporate management, and, the critics say, research is avoided in lines of work that might hurt the corporation's merchandising position.

The claim is also made that these corporation-controlled research teams often command leadership in their particular field and thus, in connection with the patent system, they tend to stifle competition in research.

Whether or not these criticisms are warranted, the American people themselves must ultimately decide, and he mentioned three proposals which have been advanced to remedy these alleged weaknesses in the present patent system.

The first proposal is that every patent, good, bad or indifferent, whether owned by individuals or by small or big corporations, should be made available for use by anyone who may desire its use and who is willing to pay a fair price for the privilege—a system of general licensing that, in one form or another, is now in wide use throughout the world.

The second proposal is that in cases where courts decide that a particular patent had been used or non-used for the purpose of unreasonably limiting the supply of any article of commerce, the patent should be declared null and void. This is generally referred to as a system of forfeiture of specific patents found to have been abused.

The third proposal is that in cases where a court decides that the invention of a particular patent is not being developed on a reasonable scale commensurate with its practical importance, an infringer should not be put out of business by an injunction but should be permitted to continue if he pay a fair compensation for the use of the invention and the research that led up to it. This proposal is generally referred to as a system of limited compulsory licensing for patents found to have been abused.

Whether these alleged abuses of the patent system are real or imaginary and whether or not any of the proposed remedies should be adopted are open to question, Mr. Kenyon said, but it is certain that new inventions are playing an increasingly important role in the lives of all people and it is conceivable that

in the future a single group of patents might vitally affect the destinies of millions of men. It is also certain that the independent or "garret" inventor, although he is still a significant contributor to the progress of science and the useful arts, is nonetheless a poor match for the modern industrial research laboratory, where trained men work with modern equipment under skilled supervision.

Industrial Silver

The continued use of silver in brazing alloys, vastly expanded through the development of new techniques during the war, may be jeopardized by Senate delays in authorizing Treasury sale of surplus silver for industrial uses, according to a statement by William G. Thurber, chairman of the Silver Users Emergency Committee, 527 Fifth Ave., New York City. The supply of the metal available to the silver using industries generally this year has varied from around 30 per cent of the volume needed in January to less than five per cent of requirements for some industries in April. In explaining the present crisis, Thurber said:

"The world has been mining less silver. The estimated production this year will be 44 per cent below the prewar level. Domestic production has fallen, very sharply.

"The visible supply of the metal available for manufacturing use in this country rapidly approaches the vanishing point. Because of this, production in some lines using silver already has been considerably curtailed.

"Silver consuming industries, including many which have expanded the use of brazing alloys, foreseeing the day of complete stoppage of supply and of production of goods, have tried for six months to avoid the present crisis by seeking to obtain legislative permission to make purchases from the Treasury stock of 'free' silver, i.e., idle metal not needed for monetary purposes of which 225,000,000 ounces are stored in West Point vaults.

"Legislation authorizing this and sponsored by both the majority and minority leaders has been passed in the House twice.

"While this crisis has grown daily more acute, Senators representing six western, silver-producing states have fought the legislation bitterly in committee in the Senate. Hearings have been prolonged by their delaying tactics.

"Silver Senators also have renewed their crusade, begun in the silver-purchasing legislation of 1934 and 1939, to force the price of all silver, whether for industrial or monetary use, to $1.29 an ounce. The present OPA ceiling price is 71 cents, as compared with a prewar level of 35 cents.

"It is estimated that American mines will produce this year less than one-quarter of the silver needed by American industries. The total need is estimated at 125,000,000 ounces while domestic production is estimated at 28-30,000,000 ounces.

"During 1946, it is estimated, 10,500,000 ounces of silver will be needed by industries using silver alloys. This use alone would call for about one-third of estimated domestic production. The cost of the year's supply of silver would be $7,450,000 at the present OPA ceiling price of 71 cents an ounce. The 'Silver Bloc' proposed boost to $1.29 would add $6,095,000, or more than 70 per cent, to the bill for this raw material, making the total for the year $13,545,000.

"It is estimated that there are above-ground stocks of silver totaling about 150,000,000 ounces; chiefly in Mexico, Cuba, Iran and Spain. Much of this is held by governments; considerable amounts by speculators.

"It is the sound contention of industrial users of silver that the legislative log-jam should be broken, and quickly; and that the Senate should act immediately to authorize industrial use of idle Treasury silver, because this would be in the interest of American industries and American consumers alike"

Resistance Welding Contest

Announcement has been made of cash prizes to be awarded in 1946 by the Resistance Welder Manufacturers' Association for outstanding papers dealing with resistance welding subjects. The total amount of the awards is $2,000, and a wide choice in subject matter is allowed in order to assure eligibility to all papers which cover worthwhile and significant achievements in the field. The contest judges will be appointed by the American Welding Society, and awards will be made at the 1946 Fall meeting of the Society.

One prize of $750 will be awarded for the best paper emanating from an industrial source, consulting engineer, private or government laboratory, or the like, the subject matter of which is concerned specifically with resistance welding. Prizes of $500 and $250 for the second and third best papers respectively, are offered in the same classification. There are also set up first and second prizes of $300 and $200, respectively, for the two best papers contributing to the advancement of resistance welding emanating from a university source, i.e., an instructor, student or research fellow.

Papers entered in this contest should be sent to American Welding Society, 33 W. 39th Street, New York 18, N. Y. For further contest details write the Society.

Stainless Steel Patents

Alien Property Custodian James E. Markham has announced that fourteen U. S. patents on the manufacture of stainless steel tubes which were seized from enemy nationals are available for licensing to U. S. citizens.

Mr. Markham advised that several of these patents disclosed new designs and devices which appear to be practical for use in this country, and that the inventions are the result of work of enemy technicians in the Düsseldorf area, the heart of the German steel industry.

Licenses are available on a royalty-free, non-exclusive basis for the remaining life of the patent. An administrative fee of $15.00 is charged for each patent licensed.

A list of the patents and complete licensing information may be obtained from the Patent Use and Development Section, Office of Alien Property Custodian, Washington 25, D. C.

Recent U. S. Patents

Among recently issued U. S. Patents the following are of Tooling interest. If you are interested in studying any of these Patents, simply advise "Patent Information Service," The Tool & Die Journal, 2460 Fairmount Blvd., Cleveland 6, Ohio, enclosing 20 cents for each Patent desired, and we will gladly forward your order to Washington.

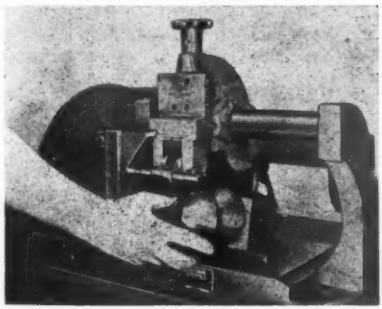
CONTROL MECHANISM FOR HONING MACHINES, No. 2,390,495.
TOOL FOR SECURING INSERTS IN TAPPED HOLES, No. 2,390,515.
MACHINE FOR SHARPENING CUTTERS, No. 2,390,521.
INSERT ASSEMBLING TOOL, No. 2,390,524.
MACHINE FOR THREADING AND CUTTING TUBULAR ARTICLES, No. 2,390,533.
METAL PLATE DIMPLING MACHINE, No. 2,390,537.
INSERTING TOOL FOR TANGLESS INSERTS, No. 2,390,545.
PROFILING AND CONTOURING TRACER MECHANISM, HYDRAULIC CONNECTIONS AND DIRECTIONAL CONTROL, No. 2,390,566.
PUNCH PRESS MECHANISM, No. 2,390,600.
HOBBING MACHINE, No. 2,390,607.
RIVET SETTING MACHINE, No. 2,390,615.
TAPER CUTTING ATTACHMENT FOR LATHES, No. 2,390,627.
SCREW DIE-HEAD, No. 2,390,647.
INDEXING MECHANISM, No. 2,390,649.
ROTARY BURNISHING TOOL, No. 2,390,651.
CUTOFF TOOLHOLDER, No. 2,390,653.
HAND PUNCH PRESS, No. 2,390,655.
SURFACE BROACH, No. 2,390,722.
DRILLING AND COUNTERSINKING TOOL, No. 2,390,744.
PEENING HAMMER, No. 2,390,795.
PROFILING MACHINE, No. 2,390,828.
ADJUSTABLE WORK SUPPORT FOR USE IN MACHINING OPERATIONS, No. 2,390,865.
STEADY REST FOR LATHES, No. 2,390,888.
RADII TOOL AND DRESSER, No. 2,390,914.
APPARATUS FOR CUTTING CURVED SURFACES, No. 2,390,927.

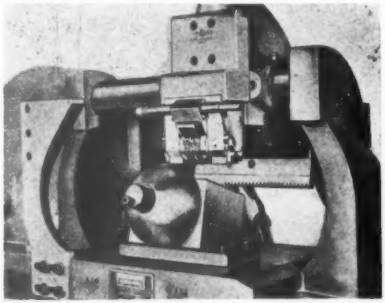
Numbering and Marking Difficult Shapes

Consecutive numbering and repeat marking can be accomplished in one operation with this new cup marking attachment. It was developed by the Acromark Company for use on their Series 9A and 9AM machines and will mark spherical, half spherical and cup shaped steel and other metals, as well as plastic parts.

The unit consists of a geared mandrel fixture with a form mounted on the mandrel to fit and hold the part to be marked. It is tilted to bring a horizontal marking position under the marking head, which is adjusted for marking depth by a hand knob on the machine itself. The first photograph shows a 9AM marking machine with the complete assembled unit, while in the second photograph, a marking stroke has just been completed and another is about to start.

A numbering machine for automatic advance is mounted in the marking head, and mortises for insert dies for repeat marking are placed in the oversize frame of the numbering machine, both before and after the numbering wheels. These inserted dies are interchangeable and held in position by set screws. At each horizontal stroke of the marking machine an angle attachment pushes down the consecutive action lever of the numbering machine, thereby assuring positive marking, for example "HYPO CUT NO. 999999 LEFT SIDE MOUNTING". A rack is placed to the rear of the marking head to mesh with the gear on the end of the mandrel shaft to insure synchronous rotation of the part being marked with the horizontal movement of the marking dies. The geared mandrel is mounted in roller or ball bearings, whichever are best suited to





the pressure requirement and will give free and easy marking action.

The Acromark Company, Dept. DJ, 5-15 Morrell St., Elizabeth 4, N. J., will promptly furnish complete details and illustrations upon request.

INFORM-A-GRAM KEY No. 636-L

Welder for Farm & Shop

The "Fleet-Arc Jr" simplifies repair and fabricating jobs on farms and in job welding shops. A development known as the "Arc Booster" provides quick, easy arc starting. The instant the electrode touches the work, the welding current is given a boost of intensity for starting the arc. The current then reverts automatically to the amount set for the job. No high voltages or special high frequency devices are used. Either of the two degrees of arc boosting, one for general work and one for thin materials, is selected by a snap switch. Current control is of the separate adjustable reactance type which is varied by turning a hand wheel. Adjustment is continuous over the entire welder range of from 20 to 180 amperes.

The Lincoln Electric Company, Dept. DJ, Cleveland, Ohio, will send complete specifications upon request.

INFORM-A-GRAM KEY No. 597-L

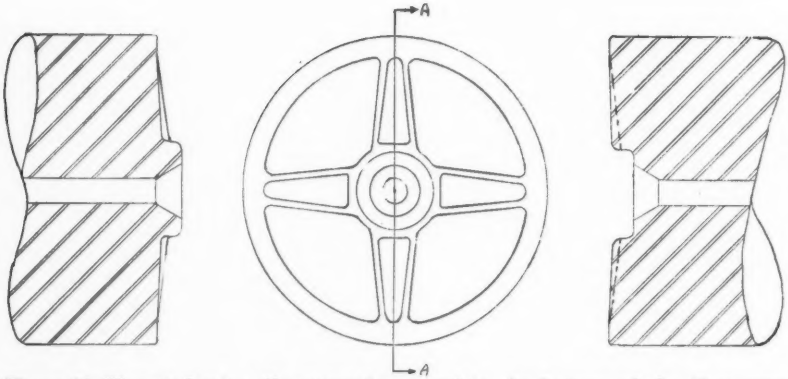


Figure 11. The reinforcing rib pattern impressed in the bottom of the filter cases by the design of the upper punch and bottoming punch.

(CONTINUED FROM PAGE 91)

of the tooling and the bill of materials for the fourth operation.

The machined steel upper die block, detail A, is bolted to the upper bolster plate, detail M, by the four standard 1" hex-head cap screws with 1" lock washers, details F and G. The hardened and ground tool steel die ring, detail C, is secured to the upper die block by four equi-spaced, standard ¾" socket or fillister head cap screws.

The machined steel punch adaptor, detail N, and the hardened and ground tool steel punch, detail E, are assembled together by the standard 2" steel stud bolt, detail P. As a further precaution against any misalignment between the punch, detail E, and the bottoming punch, detail U, four equi-spaced ½" hex-head cap screws (not shown) are used between the meeting faces of the punch adaptor and the punch proper. This is necessary because of the pattern of reinforcing ribs that is impressed into the bottom of the filter case by the design of the end of the punch and the bottoming punch. This is shown in detail in Figure 11.

As shown by the dotted lines the punch adaptor and punch assembly are drilled through with holes for air relief.

The machined steel lower die block, detail Q, is bolted to the lower bolster plate, detail T, by four standard 1" hex-head cap screws with lock washers, details F and G.

The lower, hardened and ground tool steel die ring, detail D, is bolted to the lower die block, detail Q, by four standard 1" hex or fillister head cap screws, detail R.

The faces of the upper and lower tool steel die rings are ground truly parallel and serve to flatten the top flange of the work and insure its 90° relationship to the filter body.

The hardened and ground tool steel bottoming punch, detail U, Figure 10 (see also Figure 11) is bolted to the machined steel bottoming punch adaptor, detail K, by four equi-spaced standard ½" hex-head cap screws with lock washers, details J and H. These bolts also prevent any possibility of misalignment between the upper punch, detail E, and the bottoming punch, detail U, and insure proper positioning of the reinforcing ribs that also are formed by the fourth operation.

As indicated by the lower dotted lines, Figure 10, the bottoming punch and its adaptor are drilled through with ½" holes to provide air pressure relief during both the forming stroke and the knockout. The bottoming punch in combination with the standard 1" machine bolt, detail L, serves as the knockout.

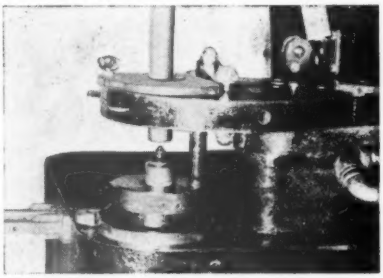
Upon completion of this fourth operation of flattening the flange and forming the ribs, the work is loaded on hand trucks for the fifth operation.

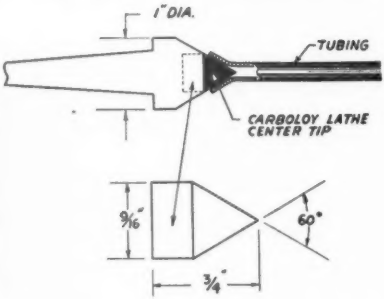
(Continued Next Month)

Hardness Testing and Tube Flaring with Carbides

The use of Carboloy cemented carbides for checking the comparative hardness inside small bores has been recently announced by Pratt and Whitney Aircraft Corp., East Hartford, Conn. The carbide is in the form of an "edge" penetrator which has an obtuse angle with a .010" radius at the edge and is mounted in a "C" shaped steel folder on a Rockwell machine. This setup permits the carbide "edge" to contact the internal threads of the nuts as shown in the photograph below. The use of this Carboloy penetrator prevents indenting or nicking of the testing edge, as would happen if steel were used. Conventional Rockwell scales cannot be used and all readings are purely relative but they represent average thread hardness since the scale used is based on readings taken from checks of both acceptable and non-acceptable threads.

Tube flaring tools made with carbide lathe center tips greatly increased production at Douglas Aircraft Co., Inc., Santa Monica, Calif. This flaring tool (sketch) is made at the Douglas plant by brazing a stock Carboloy C-6 lathe center tip of solid cemented carbide to a tapered shank having a special taper to fit the machine. The lathe center insert has a $\frac{5}{16}$" OD and is large enough that all the work is done by the carbide insert and none by the softer steel shank. These





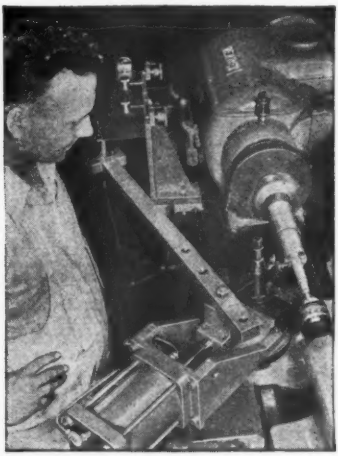
tools are used for flaring the ends of 24 and 14 ST aluminum tubing ranging from ¼" to ¾" ID. The above photograph shows a Leonard Precision Flaring Machine set up with a carbide tool. The speed range is between 350 and 1000 rpm and best results are obtained at higher speeds. These tools turn out at least 1000 pieces before they have to be reground or replaced, compared to approximately 100 tubes by high speed steel tools. Complete information on carbide tools will be sent by Carboloy Co., Inc., Dept. DJ, 11109 E. Eight Mile Blvd., Detroit, Mich.

INFORM-A-GRAM KEY No. 82-L

Simplification Features New Bailey Duplicator

Like the original contour control announced by Bailey in 1944, their new and greatly simplified duplicating attachment is a combined air and hydraulic system which may be attached to engine lathes, turret lathes or vertical boring mills to produce workpieces with contours which exactly correspond to a thin metal templet or master part.

Simplification has been achieved by applying a single hydraulic power cylinder to the lathe compound, which is



usually set at 45° to the longitudinal axis of the work. When mounted at this angle and used in conjunction with the standard longitudinal feed, the single power cylinder controls both longitudinal and in-out tool motion. Formerly, it was necessary to apply power cylinders to both the longitudinal and cross feeds for full automatic operation, but with the new Bailey Duplicating Attachment one small power cylinder produces practically the same net results.

In addition to its lower cost, the new attachment in no way hinders normal use of the machine to which it is applied. The standard controls for speeds, feeds and depth of cut function equally well with or without the attachment. The Bailey Duplicating Attachment provides automatic sizing of tapers and radii and eliminates the necessity of taking numerous repetitive measurements. After the machine operator has made the initial setup and tool adjustment, no further attention is required on his part other than to load and unload the machine, each piece being formed exactly to the contour of the templet or master part.

Step shafts, mandrels, punches, dies, valve plugs, impellers, shells, forming rolls and bottle molds are typical of work on which the duplicating attachment may be used to advantage. It is equally well suited for turning, boring or facing and may be applied to large or small machine tools. In the case of step shafts, all of the diameters, tapers, shoulders and undercuts usually may be turned in a single cut.

Further details are available from the Bailey Meter Co., Dept. TJ, 1050 Ivanhoe Rd., Cleveland 10, Ohio.

INFORM-A-GRAM KEY No. 954-L

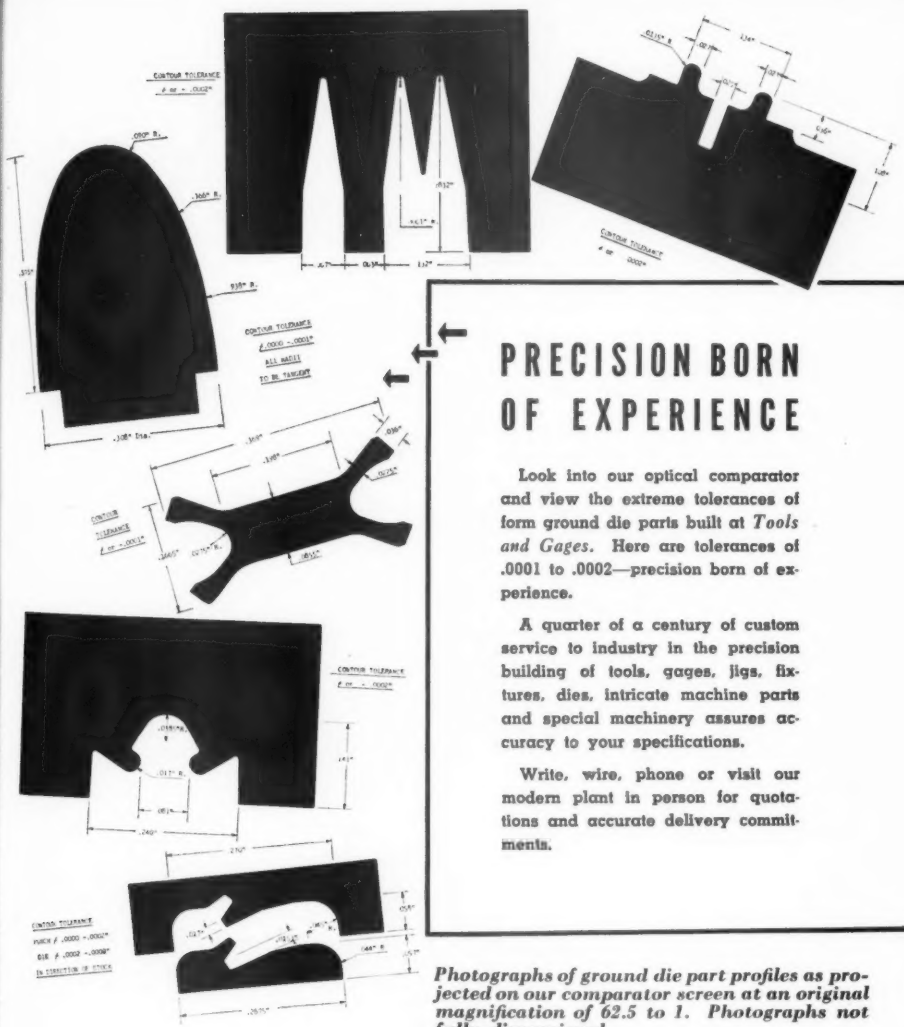
Electronics Digest

The new "Electronics Digest", a 50-page illustrated booklet recently announced by the Westinghouse Electric Corporation, records the latest developments in Electronics at Work. It contains informative articles on Stratovision, Mot-O-Trol, fluorescent lighting, electrolytic tin plating, X-ray inspection, and electrostatic air cleaning.

In addition to the articles on specific electronic applications, this booklet includes an explanation of the electron theory and of basic electronic devices. The articles, with the exception of the one on Stratovision, are non-technical digests of material previously published in technical magazines.

This booklet is designed to keep management groups abreast of the modern trends in the use of electronics and is published quarterly. Copies of the Electronic Digest (B-3726) may be secured from the Westinghouse Electric Corporation, Box 868, Pittsburgh 30, Pa., or by using our postage-free

INFORM-A-GRAM KEY No. 35-L



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MICHIGAN 7230

(CONTINUED FROM PAGE 88)
will harden as deep as any of the low alloy tool steels, but not as deep as high carbon chrome or high speed steel.

The less severe oil quench produces less warpage and fewer hardening cracks than are encountered in many tool steels. The plain carbon manganese steel hardens at a comparatively low temperature, which is advantageous with respect to scaling and dimensional changes.

With manganese as the only alloying metal, the hardening temperature is limited. Carbon content of these steels varies from 0.85 to 0.95 percent. Other elements, 0.50 chromium and tungsten, with or without vanadium, are added mainly to widen the hardening range from which a refined grain structure can be obtained, although this means that the steel has to be quenched from a higher temperature.

Manganese, oil hardening, non-deforming, tool steels have a high compressive strength but low resistance to shock or impact. They are, therefore, general purpose steels for the tool room and are good for blanking and forming dies, and many tools not subject to heavy shock.

Oil hardening die steels also include low tungsten chrome types, which are used for much the same purposes as manganese steels. They are not as commonly used because a higher hardening temperature is required and they do not harden as uniformly in large sections.

High Carbon, High Chrome Steels

Increasing demand for better wear and resistance to abrasion than can be obtained with carbon and manganese tool steels resulted in the development of high carbon (1.50-2.50%), high chromium (12-16%) steels. Both water and oil hardening types with low deformation are available. Their high resistance to wear or abrasion is roughly proportional to carbon content. These properties make high carbon, high chrome steels unsurpassed for high production dies, where economy has been shown in a wide variety of applications.

Probably the most common application is in blanking and cold forming dies. These are used in working materials ranging from light gauge silicon sheet steel to plate $\frac{3}{8}$ in. or more thick. One comparison in blanking silicon sheets 0.019 to 0.025 in. thick showed this type steel dies produced three times that of straight carbon steel and reduced die cost per million cuts more than 50 percent. Drawing dies, cold forming rolls, thread roller dies, burnishing and trimming dies are also important applications.

The high carbon chrome steels are deep hardening. Toughness or impact value is low, particularly in large sections, thus requiring an ample factor of safety in design of dies. Very large sections should be built up if possible or have a heavy backing of tough steel. Straight chromium steel with more than 2.00 percent carbon is quite low in toughness. Improvement was made later by adding vanadium and nickel. Cobalt and molybdenum have been added also, the latter to improve air hardening. Air hardening die sections of ordinary size will harden in still air to Rockwell C 60 or more.

These steels have a dense structure similar to high speed steel and a limited forging range. They absorb heat slowly and require considerable time for carbides to go into solution for proper hardening, which makes surface protection desirable during heating. After tempering, hardness is maintained better than in low alloy tool steels. Even with draws of 900° to 1000° F, more than Rockwell C 50 hardness is produced.

Machining, filing and grinding operations on these steels are much more difficult than on straight carbon and the low alloy die steels, as might be expected. The air hardening steels are somewhat easier to machine than oil hardening steels.

Air Hardening Die Steels

The latest development in cold die steels is the air hardening group originating in the high carbon, high chrome steel mentioned above. The advantages of air hardening steels are less change of dimension after hardening, greater toughness, and practically no cracking. Both 5% chrome steels and manganese steels were developed to improve on

Precision Gages Assembled From One Kit

Producto-Chek, a new gage kit perfected by the Gage Division of The DoALL Co., will actually do the work of more than a million separate gages.

Designed for production checking, it consists of a number of instruments used in conjunction with gage blocks for quickly setting up practically any type of inspection gage. A few examples of these are: the dial indicating snap gage, plain bench comparator, dual bench comparator, angle comparator, square comparator, precision height gage, depth gages, and a series of "go, no-go" snap gages of any size up to 18". It is possible to make up gages of any size in steps of .0001". In addition, gages such as hole to hole, hole to base, parallel bore gages, pitch diameter, and many others are easily made up for special applications. A set of holders from 2" to 18" in length is designed to carry the gage blocks. Besides the hand held gages that can be formed, a whole series of bench and surface plate gages may be assembled by using the base block, master flat or numerous other attachments.

There are several unusual gages, such as the indicating snap gage incorporating a dial indicator and the integral gage with dial indicator. There is an angle comparator using two dial indicators, which is set with a sine bar. When an angle identical to that of the sine bar setup is checked, the dials read alike. A multiple bench comparator that makes two measurements simultaneously is included. An outstanding instrument is the indicating square check gage. With this, the work is placed on a master flat and simply pushed against a back stop; a dial indicator showing instantly whether or not the angle is 90°. A unique feature of the kit is a set of "wires" of various diameters. These are lapped to the accuracy of gage blocks and used direct as plug gages or in caliper jaws where square jaws could not function or where combination square and round caliper jaws are needed. Although it is used in conjunction with gage blocks and in some cases a surface plate, the kit itself does not include these items.

Any of the countless gages can be assembled in five minutes or less, and it takes even less time to dismantle and replace them. The complete kit weighs only 40 lbs and is housed in a streamlined hardwood box, 10" x 20" x 4".

Additional information is available from DoALL Company, Gage Division, Dept. DJ, Minneapolis 4, Minn.

INFORM-A-GRAM KEY No. 696-L

(CONTINUED FROM PAGE 122)

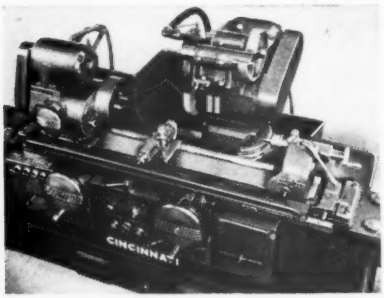
manganese oil hardening steels and to be lower in cost than high carbon chrome steels. However, their production is more difficult than manganese oil hardening types and they are more difficult to machine. Their resistance to abrasion and wear is between manganese oil hardening and high carbon chrome types. Both types are rather deep hardening and are tougher than oil hardening die steels. All have excellent non-deforming quality.

Hardening temperature for the 5% chrome type is about 1750° F, slightly lower than for air hardening high carbon chrome steel. The manganese air hardening types have the advantage of hardening at 1450° to 1550° F, in about the same temperature range as many manganese oil hardening steels, which means less scaling and distortion.

Applications, though fewer than for manganese oil hardening because they are newer, are constantly increasing and will increase faster as they become more readily available.

Cincinnati Grinding Machine Improvements

The new headstock, recently applied to the Cincinnati Universal Hydraulic Grinding Machines, provides high efficiency, positive traction and no speed fluctuation. Infinitely variable speeds—55 to 500 rpm on the 12″ grinder and 25 to 225 rpm on the 14″, 16″ and 18″ machines—are available and correct speeds are obtained by merely turning a handwheel. This unit embodies the "Speed Ranger" drive and speed change,



a mechanism consisting primarily of a ring riding on two pairs of adjustable cones. Standard chucks may be used without intermediate adapters. The chuck or face plate and work can be removed as a unit for inspection and then replaced for further grinding. Graduations at the base of the headstock are easy to read and the unit can be swiveled up to 90° forward, 30° back. A simple locking device makes the change from live to dead spindle. The above photograph shows a grinder with the standard drive plate for dead spindle work mounted in position. The other photograph shows the construction of the spindle nose with a face plate ready for mounting.

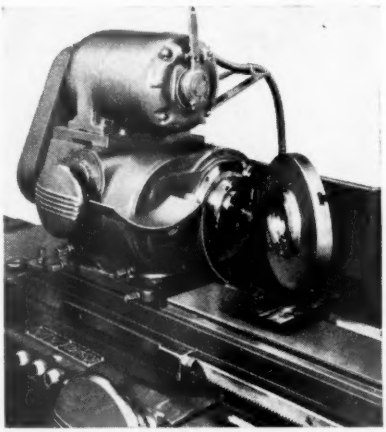
The exclusive Filmatic bearings for the grinding wheel spindle are of multiple shoe construction, steel backed and bronzed lined, and are self-adjusting for variations in load resulting from heavy or light cuts. Competely submerged in oil, the shoes create self-renewing wedge shaped oil films which rigidly and accurately support the spindle. If the oil supply fails, a pressure switch immediately shuts off the grinding wheel spindle drive motor.

A hinged internal grinding attachment is always in place and instantly available. This unit can be swung down to operating position, one hold-down bolt tightened, and it is ready for use.

Table ways are pressure lubricated with filtered oil from a circulating system. The bed has plenty of mass to dampen out vibration. Table reverse dogs, held in engagement with the table dog rack by means of a leaf spring, are readily reset without using a wrench. The work rotation and coolant automatically start and stop as the power table traverse starts and stops. The headstock rotation may be controlled independently of the table movement. Narrow guides and flat ways having liberal bearing areas, and a backlash eliminating arrangement for the rack and pinion, promote smooth cross adjustment and accuracy.

Catalogs G-486-3, featuring 12″ grinders, and G-474-2, giving data on 14″ to 18″ machines, are available from Cincinnati Grinders Incorporated, Dept. DJ, Cincinnati 9, Ohio, or use our

INFORM-A-GRAM KEY No. 233-L



(CONTINUED FROM PAGE 113)

lem requires special treatment. A careful study of this source of vibration revealed that a symmetrical mounting about the bearings reduced the magnetically caused vibration in the ratio of 13:1. The mechanical vibration from pumps is effectively eliminated by soft mountings and neoprene hose but the hydraulic vibration cannot, as yet, be controlled. In an electrical circuit transmitting direct current with one or more alternating current components, wave traps can be used to smooth the voltage. But the frequencies from a pump, which are a few hundred cycles per second, cannot be by-passed in the same way. It is impossible to design a piston and spring that will have the necessary displacement and at the same time have the correct natural frequency.

Motor Mounts

Outboard motors have been used on the premise that both the machine and motor are independently supported on a relatively immovable floor. See Figure 5. The equivalent is a heavy base supported on corner springs on which are mounted two stiffly sprung masses, one mass corresponding to the machine, the other to the outboard motor. The motor will have a vibrator fastened to it that produces a sinusoidal force. It is evident that an outboard drive should be used on solid massive floors only.

Analyzing Vibration Problems

What has been said, though admittedly not complete, indicates the general method used in analyzing vibration problems. A few examples of actual problems may be of interest.

1. An unbalanced grinding wheel that runs true after dressing. Chatter is produced by the unbalanced force that causes a relative motion of the wheel and the work. The only solution is to balance the wheel. See Figure 4.

2. Unbalanced work piece resulting in: (1) an eccentric bore, or (2) an elliptical bore when the support is not symmetrical elastically. Ordinarily, eccentricity or out-of-round will be but a fraction of a tenth. The best solution is to balance the work.

3. Failure to spark out. A workhead which was reported to spark every two and one-quarter revolutions was set up and found to do just that. A similar anti-friction bearing was rotated by hand. It was noted that one roller made a complete revolution around the center of the bearing every 2½ revolutions of the inner race. Evidently one roller was slightly large causing the geometric center to rotate about the center of rotation. New bearings solved the problem.

4. During a cylinder grinding operation it was found that a chatter of 240 c.p.s. existed. Measurements showed no sizable vibration other than 120 c.p.s., the wheel was turning 80 r.p.s., and this resulted in three spiral threads being formed on the wheel. Obviously, the wheel contacted the work three times per revolution producing the observed result. There were two possible solutions, the simplest being to replace the motor.

5. The profilometer reading of a bored sample measured 8 micro-inches. Calculation indicated the reading should be five. Vibration measurements showed a dominant frequency which, by elimination, was associated with the ball bearings in an idler pulley. Precision bearings were installed and the profilometer reading dropped to about five.

6. Sometimes resonant effects are achieved by chance which would be difficult to accomplish intentionally. A fly cutter on a Bore-Matic produced a badly chattered surface. The quill was observed to vibrate perceptibly when idle. The excitation, which just happened to be the resonant frequency of the quill, was due to mechanical vibration from

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I say look at those sharp teeth hardened to cut deep and wear longer.
Large easy-to-read markings make it a simple job to choose the correct Clemson blade for every job.
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Use the coupon to send for copy of "Metal Cutting"—a miniature textbook on selection, care and use of hack saw blades and frames.

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the pump. Rubber isolation completely eliminated the chatter.

7. A boring head with ball bearings produced an 8 micro-inch surface, which was satisfactory, but the appearance was not good. Measurement and calculation showed the front bearing to be the source of excitation. A better quality bearing reduced the profilometer reading to six, and the chatter marks could not be seen in ordinary light.

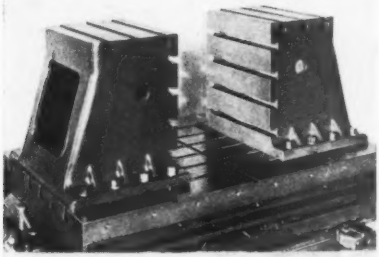
8. The final example is one which was not simple and which was solved by intuition. Two boring heads, mounted on a bridge, bored surfaces which were satisfactory in appearance. However, profilometer readings on the sides were three micro-inches greater than those on the top and bottom. A vibration analysis was made but this gave no clue to the cause. The idlers and belts were changed; the work support was stiffened; the speed was changed; the tools were changed; the table speed was changed; the heads were replaced. Though the magnitude was changed, the relative surface finishes remained the same. An attempt was then made to determine resonant effects but this yielded nothing. It was reasoned that the bridge must be different elastically in the horizontal and vertical directions and a new bridge was taken from stock having greater horizontal rigidity. This solved the problem. The difference in the two surfaces was due, probably, to a component of chatter with a peak-to-hollow amplitude of 9 millionths of an inch.

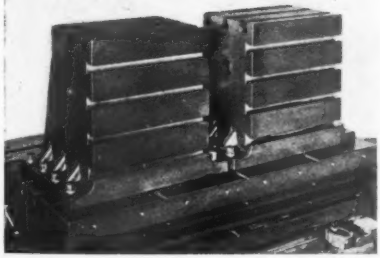
Conclusions

These examples illustrate progress; show that a fair start has been made. It is unfortunate however, that knowledge of vibration troubles is not yet sufficient to analyze all of them nor to solve those that have been resolved into problems. Someday it may be possible to set up a network, equivalent to that used to solve electric transmission line problems, from which a machine tool can be designed and built correctly the first try.

Angle Block Combinations for Work Holding

A combination of matched angle blocks for a wide range of work holding operations has recently been announced by DeVlieg Machine Company. These matched units are used for accurately locating and chucking work in boring, milling, and planing operations, as well as for toolroom and other general purpose uses.





They are machined from box section castings, with tee slots and flat surfaces in precise alignment. These blocks may be used singly or in various combinations and are suitable for either large or small work. Each set includes tee slot nuts, studs and screws ready for immediate application. All tee slots are $\frac{13}{16}$" wide with 4" centers. The vertical face

on the top member is 12" high, 16" wide and has 3 tee slots. The bottom members have vertical faces 18¼" high, 16" wide and 4 tee slots.

Additional information on these convenient angle blocks is available from the DeVlieg Machine Company, Dept. DJ, 454 Fair Avenue, Ferndale 20 (Detroit), Mich., or use our postage-free

INFORM-A-GRAM KEY No. 574-L

Elected Vice-President

Mr. Henry A. Stix was elected executive vice-president of The Federal Machine and Welder Company of Warren, Ohio, and its subsidiaries, Warren City Mfg. Co., and Sommer and Adams of Cleveland. Mr. Stix has an unusual background of industrial organization and management and is widely known in national financial and management counsel circles. Part of his new duties will be to speed up the production of postwar products.

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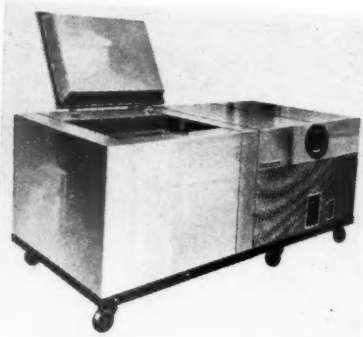


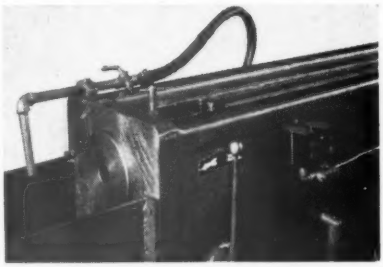
A most recent development in the industrial refrigeration field is the acquisition by Bowser, Inc. of the Kold-Hold interests. The organization will be known as Bowser, Inc., Refrigeration Division, and located at Terryville, Connecticut, with sales offices in New York, Washington, Cleveland, Chicago and San Francisco. Manufacturing facilities, formerly at Woodside, Long Island, have been expanded and moved to Terryville to produce Bowser–Kold-Hold 5.4 and 11 cu ft chilling machines capable of economically attaining —150°F, and the Bowser "Utility" production testing unit which offers a range of from +150°F to —90°F, with altitude simulation by vacuum control. Inform-A-Gram Key No. H71-L.

American Horizontal Broaching Machine

The new type horizontal broachine machines, designed by American Broach and Machine Co., pioneers in the broaching field, incorporates all the proven and desirable features required in heavy-duty broaching machines. They are especially adapted for internal broaching operations, as well as surface broaching, involving the removal of large amounts of metal. A unique feature is the new design of the machine bed. In the past, a single wall cast iron or steel fabricated bed was used; now, the new type HD machines have a rolled wall construction which forms double walls throughout the bed and lends greater strength and rigidity to the base than the former construction.

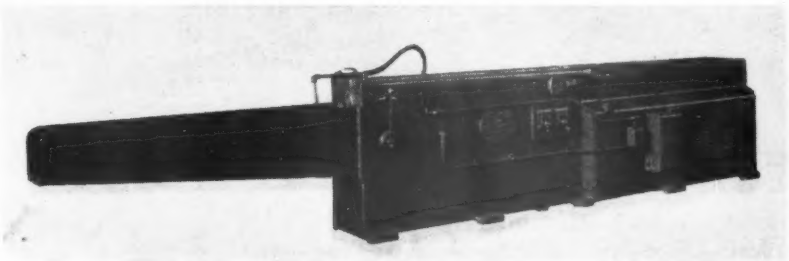
An outer support table which eliminates manual handling of the broaching tool and provides a guide for the broach rear pilot and an automatic support jack for the broach shank is also available. The slide is equipped with ball bearings to reduce wear and facilitate movement.

These machines are available in two sizes. The HD-15-66 model has a normal capacity of 15 tons and a maximum of 19 tons. The HD-20-66 type has a 20-ton normal capacity and a 29-ton maximum.



American Broach and Machine Co., Dept. DJ, Ann Arbor, Mich., will send full details on these machines which help turn out products speedily, economically and accurately.

INFORM-A-GRAM KEY No. 708-L

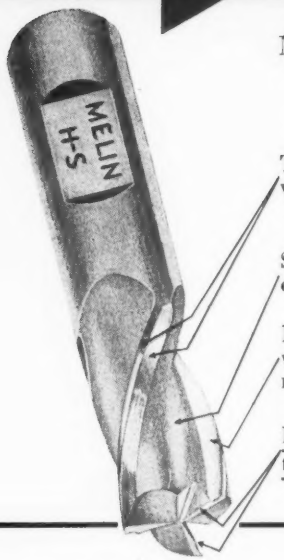


Canning The Surplus

Industry, business and Government can now copy the housewife's thriftiness and "can" their surplus materials. By means of ingenious aluminum "barriers", some of which "breathe" through a drying agent and others which are hermetically sealed, surplus articles and materials can be stored in the open for years without rust, corrosion and deterioration. At night and under cloudy conditions these barriers inhale air through a screen of silica gel, and in sunlight they exhale air through this gel, thus drying and reactivitating the desiccant automatically. Surplus war materials may be "canned" and stored in the open on Government reservations, eliminating the necessity of warehouses. Glenn L. Martin Co., Dept. DJ, Baltimore 3, Md., will furnish further details.

INFORM-A-GRAM KEY No. A23-L

DRILL THEN MILL *with Melin End Mills*



MELIN 3-FLUTE, Bottom Cutting End Mills will do your jobs better and faster because:

The combination of first and second back offs provides stronger, keener, longer lived cutting edges.

Scientifically designed flutes guarantee extra sturdiness and more efficient chip disposal.

Hollow ground flutes permit faster, cleaner cutting with minimum heat generation,—all decarburized metal ground off.

Exclusive bottom cutting design permits drilling to desired depth before side cutting.

Flute design provides perfect balance,—eliminates flutter, chatter and excessive spindle strain at high speeds,—permits roughing and keyway milling to be done within closer limits and with a smoother finish. CONCENTRICITY GUARANTEED.

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Territories open for sales representatives.

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Dept. TD, 1331 Phillips, S. W.
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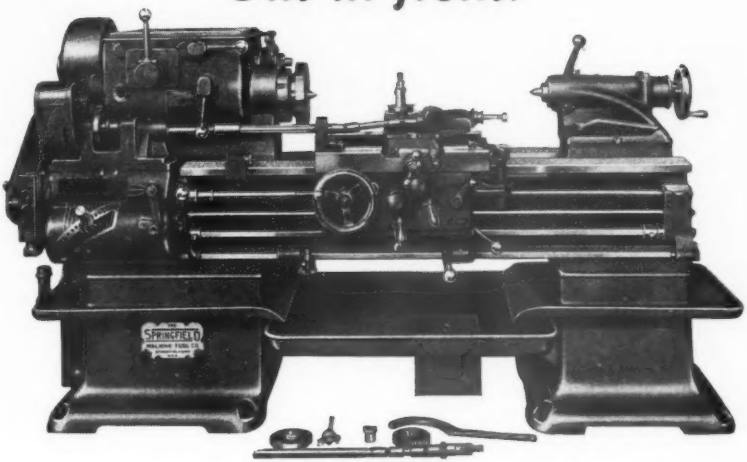
SPRINGFIELD PRECISION LATHE

Out in front!



● Headstock . . . twelve speeds . . . only half of the easy-shifting spur gears mesh at one time.

Motors . . . V-Belt or silent chain drive.

Bed . . . permanently true—made of high test alloy to resist warp or marring under severe service.

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Tells the why and how of Springfield's accurate production.

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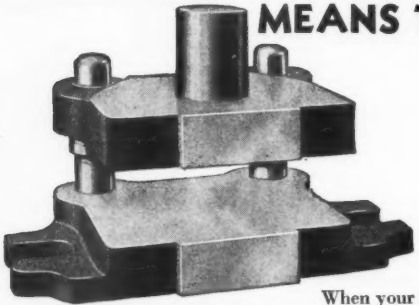

When your Producto Die Sets go on the job they will be *exactly* according to your specifications ... and will assure you quick set-up and long trouble-free production runs.

Every factor in construction and material used is carefully checked before shipping ... saving you time and money by eliminating any error.

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PROGRESS ON PARADE

Use our postage-free Inform-A-Gram for your requests.

NEW WYCO HY-SPEED SAWS, designed for fast and dependable work, are available from WYZENBEEK AND STAFF, INC., Dept. TD, 838 W. Hubbard St., Chicago 22, Ill. Attached to any ¼" electric drill, air drill, or flexible shaft, the Wyco Hy-Speed Saw is

used to file and saw metals, wood, and plastics. It chucks in either a drill chuck or collet and utilizes both ordinary hack saw blades and standard ¼" shank machine files. In addition to being easily usable in otherwise inaccessible locations, the Wyco Hy-Speed Saw incorporates a new square plunger with a take up for wear so that it saws absolutely true. Though it employs neither gears nor cams, this saw has rotating parts which are all ball bearing and run in oil while every one of its bearings is heat treated.

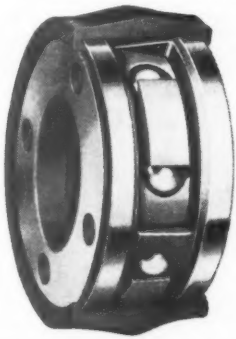
INFORM-A-GRAM KEY No. 533-L

THE AMIC QUICK ACTION VERNIER CALIPER of a multi-purposed type replaces various precision measuring tools. The demand is fast growing for this new caliper which is introduced by AMERICAN MEASURING INSTRUMENTS CORP., Dept. DJ, 240 West 40th St., New York, N. Y. Both ID and OD dimensions in thousandths may be easily and immediately read with the Amic Quick Action Vernier Caliper. Besides, the direct reading scale is usable for depth measurements up to 5". Featuring a one-piece sliding member and completely open face, this caliper is

available in either stainless or tool steels. Every Amic Quick Action Vernier Caliper is furnished with an attractive and durable leather case for convenient pocket carrying.

INFORM-A-GRAM KEY No. 186-L

BALLFLEX FLEXIBLE COUPLINGS which accommodate up to ⅛" of parallel misalignment and that of angularity as high as 3°

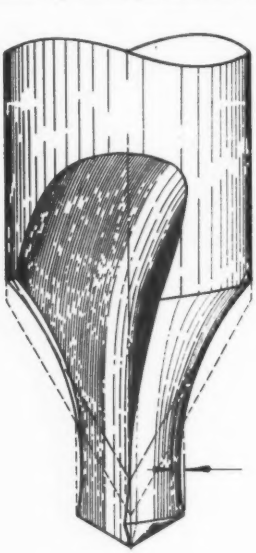


are announced by THE GEAR GRINDING MACHINE CO., Dept. TD, 3901 Christopher, Detroit 11, Mich. Ballflex Couplings incorporate hardened and ground steel torque

transmitting balls, which practically eliminate friction. The many directioned, free rolling movement of this coupling eliminates side thrust as well as bending and springing of both the coupling and mounting bearing parts. Neither discs of rubber or fiber nor sliding members, but a synthetic product used in the Ballflex overall seal is its only flexible element. Being impervious to oil, this flexible element constantly retains lubricant though it completely and permanently repels dust and liquids. No extra lubricant is needed besides that which is packed with the coupling and for its lifetime is sealed in. The Ballflex Coupling is installed by simply being inserted between and bolted to the flanges on the two shafts without backing them away.

INFORM-A-GRAM KEY No. B42-L

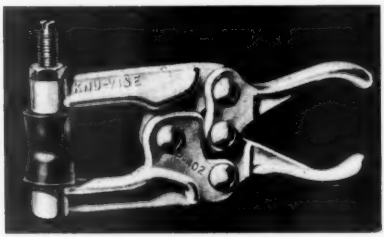
HY-CO CENTER DRILLS of radial strength, resulting from their Sphere-O-Form contours, have proven by actual performance that they



outlast ordinary tools more than from two to four times. These drills are introduced by HOWARD H. HEINZE, INC., Dept. DJ, 318 Boulevard Bldg., Detroit 2, Mich. Hy-Co Center Drill design incorporates: a chip jamming preventive spiral groove; helically relieved cutting surfaces of increased efficiency which provide greater freedom of chip flow, smoother machining and thereby a prolonged cutting life; and enough tip clearance to materially reduce breakage. Like other high quality tools, the Hy-Co Center Drill may be resharpened while its automatic safety center feature renders it usable in place of two center drills. By use of these drills, both deburring and center grinding operations as well as damage to lathe centers are eliminated. Thus longer lived Hy-Co Center Drills not only minimize tool expense and greatly reduce work spoilage, they also effect great savings in production cost.

INFORM-A-GRAM KEY No. H42-L

TOGGLE PLIERS designed particularly to hold small work for welding, drilling, riveting, and sub-assembling in limited space are introduced by KNU-VISE, INC., Dept. TD, Detroit, Mich. Among the four available models, the P-402 illustrated herewith has a throat gap of $\frac{7}{16}$" by $1\frac{3}{16}$" and two rubber caps. The other models are: P-400, with a $\frac{1}{16}$" by $1\frac{3}{16}$" throat gap; P-401, with a ½" by $1\frac{3}{16}$" throat gap and one rubber cap on its spindle; and P-400 VG, with a vari-grip spring which may be set so the pliers grip loads weighing from 10 to 40 lbs. A normal forty-pound hand pressure applied to the handles



is multiplied to 400 lbs of work contact pressure. A screw driver slot provides for easy adjustability of the pressure spindle; its adjustment locking nut is positioned to receive a minimum of pressure. Though they may be widely opened, a comfortable grip is furnished by the curved plier handles which close to a definite locking stop for holding work. The pressure pad is shaped to hold its rubber cap firmly positioned, and to leave no depression in the work being held. Each of these pliers is a 4-oz, all steel, cadmium plated forging of 4¾" in length by 1¾" in height, exclusive of the spindle.

INFORM-A-GRAM KEY No. 649-L

60% More Parts

WITH A Barker

WRENCHLESS CHUCK

Production went up from 75 to 120 parts per hour when the Atlantic Brass Works installed a Barker Two-Jaw Wrenchless Chuck. The part is a bronze plug for a ground key valve. The operations are center, face, and box mill. The lathe is not stopped to set or remove the work.

Barker Two-Jaw Chuck

Barker Three-Jaw Chuck

This step-up in production is typical of new output records being made by users of Barker Wrenchless Chucks and Vises—more parts per hour, lower cost, and less operator fatigue.

Barker Two-Jaw Vise

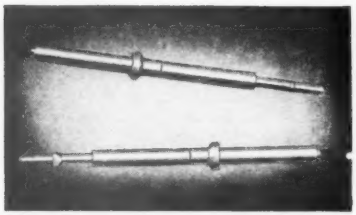
Barker Three-Jaw Vise

You, too, can have continuous and generous dividends by installing Barker Wrenchless Holding Devices. Write today for full information.

THOMAS HOIST CO.
Chuck Division
20 So. Hoyne Ave., Chicago 12, Ill.

PRECISION PARTS

FROM STEM TO STERN



From the machining of the blank to the inspection of each finished piece, the production of these stainless-steel valve stems was a typical Ace job . . . typical in its accuracy, typical in its economy. If you are thinking of a source of supply for small parts and assemblies, it will pay you to consider Ace.

RELY ON ACE FOR PRECISION GRINDING Centerless, Internal Cylindrical, External Cylindrical, Blanchard Surface, Plain Surface, and Thread Grinding.

PRODUCTION MACHINING Turning, milling, drilling, cutting, tapping, and threading of small machine parts that require precision grinding—on a mass-production basis.

METAL STAMPING Blanking, forming, and extruding of small metal parts on presses up to 75-ton capacity. Spot welding, sub-assemblies and assembly of intricate radio and machine parts.

HEAT TREATING Electric and gas furnaces, individually pyrometer controlled, for high-heat, quenching, and carburizing of parts up to approximately 10"x10"x15".

TOOL AND DIE WORK All operations for the production of Punches and Dies for small stampings, for Jigs, Fixtures, Gages, Moulds, Form Blocks, Tool Bits and Circular Form Cutters.

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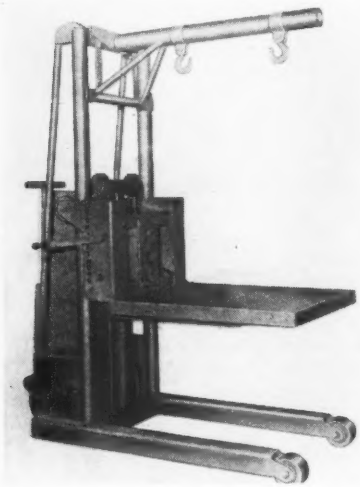
1217 E. ERIE AVE., PHILADELPHIA 24, PA.

PROGRESS ON PARADE

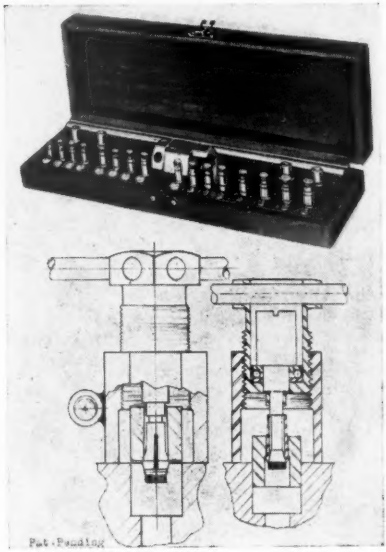
A DIE SEPARATOR AND WINCH, practically indispensable accessories, are now marketed for use with the Lyon-Raymond 2000 lb capacity High Lift Trucks. Either a motor driven hydraulic pump or a hand pump is standard equipment for raising and lowering the die separator. The die separator consists of a removable "hook-over" boom with adjustable hooks. When a die top



is fastened by chains to these hooks the two die sections are easily separated as the truck platform is lowered. Dies and fixtures may be simply pulled in and out of racks and presses by means of the 38 to 1 ratio, gear type winch bolted to the platform back plate. The die separator and winch are procurable either at the same time as the standard model truck is purchased, or at a later date from LYON-RAYMOND CORP., Dept. DJ, 2652 Madison St., Greene, N. Y. Not only is the difficulty and hazard of die handling nearly eliminated, danger of damage to dies through mishandling is likewise greatly minimized by use of these die separators and winches.

INFORM-A-GRAM KEY No. 374-L

BOLDUC EXTRACTORS designed for removing pierce die inserts, within a few minutes of time, are announced by BOLDUC SPECIALTIES CO., Dept. TJ, 10074 Beechdale Ave., Detroit 4, Mich. These extractors are used for both straight and tapered hole type pierce die inserts in the tool room or while the die is in the press. In addition, it removes slip fit inserts which are held by set screws or patented locks. The Bolduc Extractor's pulling power is only limited by the smallest extractor's thread tensile strength of well over 4300 lbs. Model 32B, the set illustrated herewith, comprises 16 extractors which accommodate inserts for holes of from .258 to .510 inclusive. Another extractor set, Model 48B, accommodates inserts ranging in hole size from .505 to .760 inclusive. Other such sets are made to specifications for liners, ball bearings, bushings, etc. The best available alloy steel, heat treated, composes Bolduc Extractors. In using



them, the proper size of extractor is selected; it is then assembled with an adaptor; next the jack is inserted; and finally the insert is pulled in less than a minute. Plain markings identify all the extractors in this set which is furnished in a wooden case as shown herewith.

INFORM-A-GRAM KEY No. H61-L

MIDGET TYPE SPRING JIGS for handling small items such as radio parts and electrical devices and a large variety of other small articles is now offered by SIEWEK TOOL DIV.

How do *YOU* measure manpower?

Does manpower in your welding department mean numbers of men—or do you, more logically, measure manpower in terms of production?

Because welding is becoming increasingly important in every phase of production today, it is important that your welding be done faster, better and more economically. If welders are using cranes or spending time propping up, turning over and flopping their weldments, they are interrupting production and increasing costs on every foot of welding.

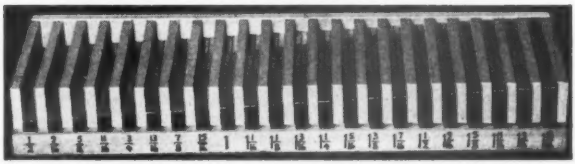
Investigate the demonstrated advantages of C-F Hand or Power-operated welding Positioners and see how they can help your welders produce better, faster and more economical welding. Welders can swing weldments into any position because every weld is downhand; larger electrodes can be used with resulting savings in time and material. For production welding, C-F Power-operated Positioners are unequalled—equipped with either variable or constant speed table rotation and power tilt. C-F Positioners have been setting new standards in production welding in many varied industries. Write for Bulletin WP-22 and more details. Cullen-Friestedt Co., 1316 S. Kilbourn Ave., Chicago 23, Ill.

CULLEN-FRIESTEDT CO., CHICAGO 23, ILL.

C-F positioned welds mean better, more economical welds

ANTON PARALLELS

AVAILABLE NOW — IMMEDIATE SHIPMENT



INCREASE PRODUCTION IMPROVE QUALITY OF WORK

ANTON PARALLELS A LONG FELT NEED—permanently straight and accurate, yet priced for everyday general machine shop use.

ALL PARALLELS FULLY GUARANTEED—To be within the limits specified.

MAXIMUM SIZE TOLERANCE .001 INCH ON GROUND SIDES—Maximum Variation in Parallelism and Straightness within length .001.

ROCKWELL "C" HARDNESS 65 UP.

ANTON PARALLELS COME IN THREE STANDARD SIZES—

¼" Thick x 6" Long—½" to 1⅛" High in Steps of 1/16" ..... $85.00 per set—22 pairs

½" Thick x 6" Long—1⅛" to 1⅛" High in Steps of 1/16" ..... $71.00 per set—11 pairs

$106.00 per set of 11—3 each size

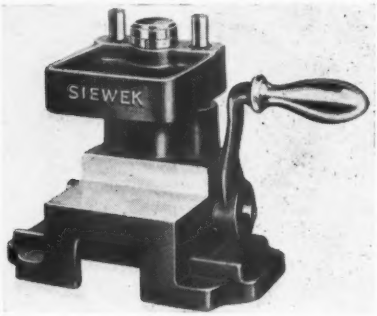
¾" Thick x 6" Long—1⅛" to 1⅛" High in Steps of 1/16" ..... $88.75 per set—11 pairs

Price per set includes large Wooden container—Large Stock of Single Pairs also available—All Prices are F.O.B. New York.

DEALERS — Morris Abrams, 196 Centre St., New York, N. Y.
Arrow Machine Tool Co., Inc., 251 Richmond St., Providence, R. I.

ANTON MACHINE WORKS - 52 SANDS STREET BROOKLYN 1, N. Y.

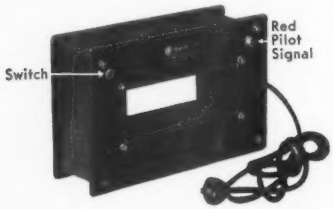
of DOMESTIC INDUSTRIES, INC., Dept. TJ, Chicago, Ill. This new 6½ lb jig, known as No. 1500 in the Siewek product line, is built like their other Midget Type Jigs to highly accurate precision standards for fine work. Ample chip clearance, absence of backlash, and possible right or left-hand operation are



some of the features of this jig. With its spring tension quickly adjustable by lock nuts at the post heads, this jig has a powerful, positive locking hold unaffected by chatter. Otherwise, it may be quickly released. A Siewek Midget Type Spring Jig, with an interchangeable re-drilled top plate and fitted with new adapters, is quickly adjustable to an additional job and a saver of considerable re-tooling time. Thus at mere fractional cost of a new unit, the single No. 1500 Midget Spring Jig accommodates many different articles.

INFORM-A-GRAM KEY No. C90-L

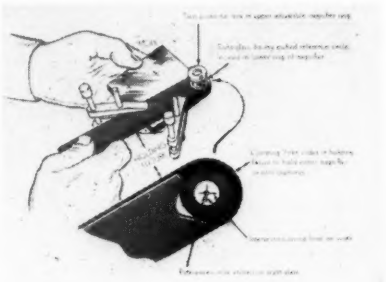
AMC DEMAGNETIZERS minimize tool breakage and entirely eliminate magnetically dulled drills and tools. These demagnetizing units



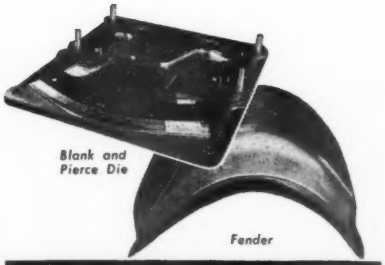
are featured by the ALOFS MFG. CO., Dept. TD, 1615 Madison Ave., SE, Grand Rapids 7, Mich. Tools of any length and thickness of up to 2¾" by 8¼" are accommodated by the AMC unit. It is available in either of two standard, portable models; the smaller, 21 lb unit is 13" x 7⅞" x 4", and is powered by 115 V, AC; the larger models of 25 lbs weight each are 15" x 10" x 4" in size and are operated by current of 220 V, AC. Both models have smoothly finished, flat, scratch-proof plastic backs. The AMC is operated by turning a toggle switch, thereby energizing the unit's coil while lighting a pilot signal. Then the part to be demagnetized is passed once or twice through the encircling coil. Tools may be magnetized by being placed in the coil opening and left there while the switch is turned and the unit energized. After the switch is turned off, the tool is removed. Cutting tools, drills, punches and any metal parts of suitable size, when passed through the coil opening are always promptly demagnetized by the AMC unit.

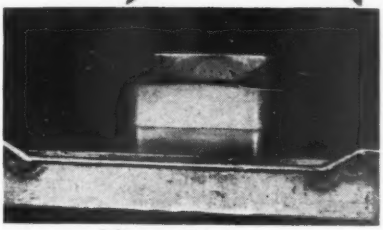
INFORM-A-GRAM KEY No. 996-L

CENTER-LOCATORS are guaranteed time savers for precision drilling use. Optical Center-Locators are employed for drilling large holes in thin material, in making pilot holes for counterboring, and for center punching with the $\frac{5}{32}$" bushing in the furnished set. In constructing drill jigs, piercing dies, molds, templates, metal patterns, and machine parts, hole centering accuracy must be maintained. For these purposes, the enthusiastic mechanics who use Optical Center-Locators claim



they provide the most simple, speedy, and positively accurate method of locating centers that has been devised. Shop size Optical Center-Locator sets include: an adjustable optical magnifier; a holding fixture; 16 precision ground, hardened, and individually labeled drill bushings in sizes of from $\frac{3}{8}$" to $\frac{1}{16}$"; 1 center punch hardened and ground to accu-





Refrigerator Hydrating Pan

DOUBLE-TREBLE AND DOUBLE AGAIN

Because of its unusual qualities cast-to-shape dies of Strenes metal outserve dies of more conventional metals many times over.

That is a "large" statement but the evidence may be obtained direct from builders of

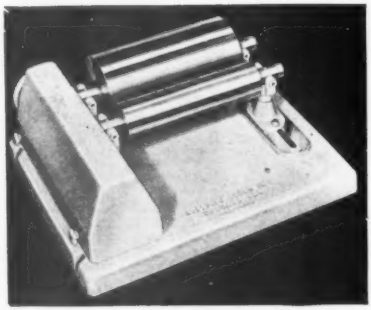
Refrigerators, Stoves, Motor Cars, Trucks, Tractors, Grave Vaults and others with drawing and forming operations to handle.

Have us identify a few users—you can contact them for the "low-down" on Strenes metal as a tooling program expediter.

The Advance Foundry Company
DAYTON 3, OHIO

Strenes METAL
FOR DRAWING AND FORMING DIES

SPEEDS LAPPING OPERATIONS



• New Roller Lapping Machine Reduces Rejections to a Minimum

A new tool that every shop can use—the SPITFIRE ROLLER LAPPING MACHINE. Operates on a new principle. Laps plugs, pins or rods to a mirror-finish in about ⅓ of the usual time. Cuts lapping rejections to a minimum. Eliminates need for rings and chucks. Work can be removed for measurement and replaced without stopping machine. Tapered plugs and plugs with shoulders are lapped as easily as straight ones.

Work to be lapped is placed between two revolving precision ground rollers of different sizes which have been charged with abrasive. The work is pressed against them with a notched fibre stick. Friction of the rollers causes work to revolve and the difference in the surface speed of the rollers causes a lapping or polishing action on the plug.

Actual shop use shows that the roller lapping method drastically reduces the number of necessary operations, as compared with the old "ring lap" method . . . produces superior results and saves time, labor and spoiled material.

SPITFIRE TOOLS, Inc.

2931 N. Pulaski Rd., Chicago 41, Ill.

WRITE TODAY

Spitfire Tools, Inc.
2931 N. Pulaski Rd.
Chicago 41, Illinois

Gentlemen:

Send free bulletin with complete information on the New Spitfire Roller Lapping Machine.

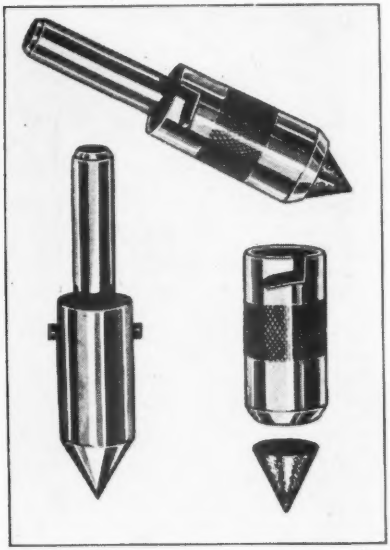
Name.....

Address.....

rately fit the $\frac{5}{32}$" bushing; a hinged compartment type case and an instruction sheet. Further information regarding Optical Center-Locators is available from MASTER SPECIALTY CO., Dept. TJ, 57 Cedar Ave., Minneapolis 7, Minn.

INFORM-A-GRAM KEY No. E64-L

CENTER LAP TOOL, used for center lapping of tools after heat treating and before grinding, has recently been developed by the J. R. REICH MFG. CO. The tool features an easily replaceable emery cloth cone fitting over an



accurately ground 60° mandrel. The cones are formed with a curved seam that assures accurate lapping with no chatter, and are available in 100, 120 and 150 grit. The cones are held securely on the mandrel by a sleeve with a quick acting bayonet lock, making it possible to change cones in a matter of seconds. The tool has a $\frac{1}{8}$" shank which fits any lathe or drill chuck. Further information is available from J. R. Reich Mfg. Co., Dept. TJ, 45 E. Stroop Rd., Dayton 9, Ohio.

INFORM-A-GRAM KEY No. E95-L

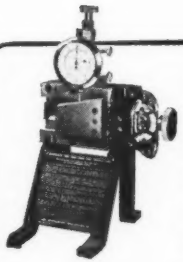
REVERSIBLE GAGE & WIRE SET CABINETS holding complete standard gage sets are introduced by The Size Control Div., AMERICAN MACHINE & GAGE CO., Dept. TJ, 4636 W. Fulton St., Chicago 44, Ill. These thread gages are of the Size Control (pat. pend.), reversible design. This provides two or more gage members for the price of just one; and it also makes a most economical type of plug gage. The gage sets comprise either partial or complete thread series, and are packed in durable, neat and compact storage or carrying cabinets with easily identifiable holes for all sizes. Plain plug gages, reversible, and of Size Control design are available in: old or

new ASME recommended drill sizes; fractional sizes; any combinations in .001" increments; or in any other order of sizes. Standard thread or gear wire sets conforming to Bureau of Standards' specifications in any recommended series are available from stock. Size Control gages are especially valuable for experimental laboratories, or shops requiring the gaging of many and varied short run jobs.

INFORM-A-GRAM KEY No. G90-L

BORING & FACING TOOL HEADS, time savers, which increase machine earning capacities, are explained in a new folder by CHANDLER TOOL CO., Dept. T-6, 514 Ohio Ave., Muncie, Ind. Boring, facing, turning, and grooving are all handled by this one head. Its standard equipment includes: a No. 4 or any other shank; a 4" long by ¾" dia boring bar with ¼" sq end holes; an extension bar; an adaptor; a lock nut; the necessary wrenches and a wooden container. In any head, all types of interchangeable shanks are screwed in. The quality and workmanship incorporated in each of these tool heads is fully guaranteed.

INFORM-A-GRAM KEY No. 820-L



CLARKATOR CHECKS DIAL INDICATORS

MASTER DIAMOND CHECKING SET

CLARK

Gives Continued Accuracy, Rapid Measurements

THE CLARK has everything you want in a hardness tester—direct reading precision dial, durable construction, ease of servicing. Three standard models shipped complete with weights, dust protectors, diamond and steel penetrators, test blocks, and anvils.

CLARKATOR CHECKS DIAL INDICATORS with micrometer speed and sine bar accuracy. Easy to operate—just four simple steps. Complete instructions permanently fastened to base.

MASTER DIAMOND CHECKING SET eliminates hardness tester errors. Consists of a master diamond penetrator and two test blocks. Precision is assured over a long period because the set is used only for checking. Furnished in leather case.

Learn the truth about hardness testing! This 20-page reference manual (right) contains information on history, theory, practice, and equipment for modern hardness testing. Available to executives without charge. Write Dept. MMS today!

CLARK HARDNESS TESTER

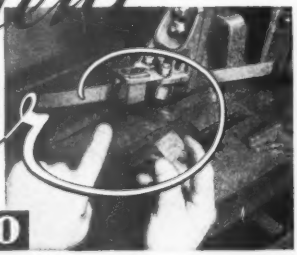
CLARK INSTRUMENT, INC.

10200 Ford Road. • Dearborn, Mich.

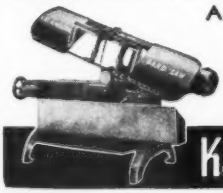
Wire brush cleaners of special design remove all chip adhesions both before and after the cut. This contributes to Cleaner, Faster Cutting and Longer Blade Life.

The brushes fit into a special holder and may be reversed or quarter-turned for even wear and to prevent matting. Eliminates faults of stationary or rotating type of brushes that wear unevenly and must be constantly replaced.

Efficient SAW TOOTH *Cleaner* with the KALAMAZOO



Ask your dealer or write direct for complete information.



MACHINE TOOL DIVISION
KALAMAZOO TANK & SILO CO., Kalamazoo 16, Mich.
In Canada — BRIDGE MACHINERY CO., Montreal

Kalamazoo *Metal Cutting* Band Saw

Quick Acting

Johnson

FURNACES

JOHNSON Hi-Speed No. 120

Reaches 2300°F. in 30 Minutes from a COLD START to Speed Up Heat-Treating Operations at Low Cost.

1500°F. in 5 Minutes!

No. 120 Bench Type

Designed primarily for high-speed steels, this powerful Johnson No. 120 Bench Furnace is equally efficient for heat-treating ANY carbon steel tools, dies or small metal parts. Reaches desired operating temperature FAST to get the job done quickly and economically. Saves time and gas. Easily regulated with accuracy. Firebox 5 x 7¾ x 13½ lined with high temperature insulating refractory. Furnished complete with Carbofrax Hearth, G.E. Motor and Johnson Blower.

No. 120 Bench Furnace $104.50

F.O.B. Factory

There is a Quick Acting Johnson Furnace for Every Heat-Treating Need. Write for Literature.

JOHNSON GAS APPLIANCE CO.
575 E Avenue, N. W., Cedar Rapids, Iowa

Please Send Quick-Acting Johnson Furnace Literature.

Name.....

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HIGH PRODUCTION AT LOW COST

REG. U.S. PAT. OF.

HY-PRO TAPS

By threading more holes per tap you can increase your production and lower tapping operation costs with HY-PRO Ground Thread Taps.

These high production taps are scientifically produced to give longer, more accurate service, and longer wear between sharpenings.

HY-PRO method of packaging makes crush-proof box a miniature tool box that fully protects taps and offers many time-saving advantages. Tension cover prevents spilling and injury to taps. Legible, informative labels are color-coded to save inventory time, and their position on cover prevents mixing of sizes when taps are returned to box.

PROMPT DELIVERY
Many special as well as standard taps in stock

COMMERCIAL PRECISION SPECIAL Ground Thread Taps

Write for Catalog on Company Letterhead

HY-PRO TOOL CO.
New Bedford, Mass., U.S.A.

Accurate Spacing- *by the Thousandths*

De-Sta-Co Arbor Spacers

Save time in setting up milling machine cutters, and wherever accurate spacing must be obtained and *maintained.*

Made of metal. Not only for greater accuracy, but also because they will not be affected by heat or oil. And can be used over and over. Standard sizes from .001" to .125". Specials, cut from bar stock, in any length and ground to decimal.

Order a set of De-Sta-Co Spacers from your Mill Supply Distributor today.

DETROIT STAMPING CO.
Established Over 30 Years
344 Midland Ave • Detroit 3, Mich.

Hissing Air Guns are expensive!

Leaking Air Guns *waste* power and *cause needless wear* of air compressors. That is why leading plants use AIR-O-CHEKS—the *Leakproof* Air Guns *that have no packing glands.*

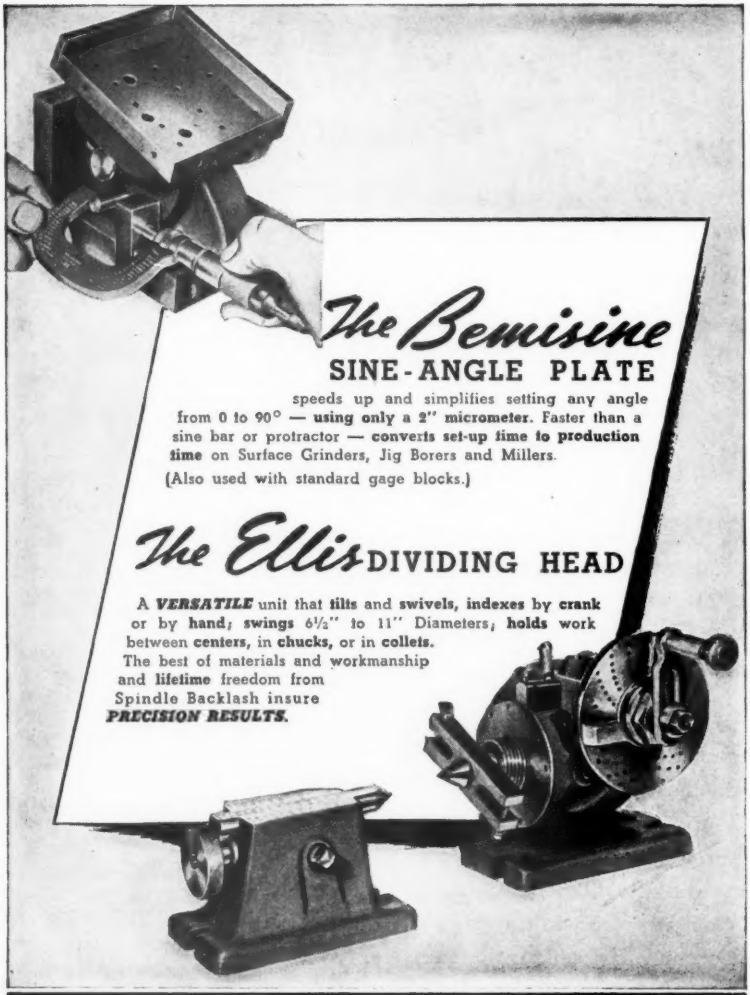
Streamlined to the hose. Easy to grip, easy to use.
Made of bar brass and stainless steel.
The patented ball and socket joint between the lever and the valve affords full discharge with a slight flex of the hose.

Sizes for all requirements. Send for Catalog.

Comparison *quickly demonstrates* AIR-O-CHEK superiority. That's why four out of five plants *standardize* on AIR-O-CHEKS after a comprehensive test.

Try it. *Install a dozen* AIR-O-CHEKS *and compare results.*

AIR-WAY PUMP & EQUIPMENT CO.
411 S. Jefferson St., Chicago 7



The Bemisine
SINE-ANGLE PLATE

speeds up and simplifies setting any angle from 0 to 90° — **using only a 2" micrometer.** Faster than a sine bar or protractor — **converts set-up time to production time** on Surface Grinders, Jig Borers and Millers.

(Also used with standard gage blocks.)

The Ellis **DIVIDING HEAD**

A ***VERSATILE*** unit that **tilts** and **swivels, indexes** by **crank** or by **hand; swings** 6½" to 11" Diameters; **holds** work between **centers,** in **chucks,** or in **collets.**

The best of materials and workmanship and **lifetime** freedom from Spindle Backlash insure ***PRECISION RESULTS.***

NICHOLS-MORRIS CORPORATION
44 CHURCH STREET, NEW YORK 7, N.Y.

PUBLICATION PREVIEWS

Keep Informed! CATALOGS • BULLETINS • SPECIFICATIONS

Use our postage-free Inform-a-Gram for your request

STUDLER ANGLE COMPUTER Model G is a precision tool used for layout and inspection of tools, dies, jigs, fixtures, castings, patterns, and forgings. It is described and illustrated in a folder recently issued by THE ANGLE COMPUTER CO., Dept. T-9, 1709 Standard Ave., Glendale 1, Calif. Users of Studler Angle Computers report they do the work in from one-half to one-tenth of the time required by former methods. With the number of available skilled workers being so limited, greater dependence upon the accuracy of machines and tools is unavoidable. Therefore, Model G Angle Computers fulfill an acute industrial need.

INFORM-A-GRAM KEY No. 100-L

ELECTRONIC COUNTERS as well as their fundamental principles are explained in a bulletin published by LANSING ENGINEERING CO., Dept. T-3, 934-36 Clark St., Lansing 6, Mich. Connectable to any electrically operated production machine, this counter indicates or permanently records the number of times the machine performs a specific routine operation or produces a standard part throughout the working day. Extremely accurate and tamper proof counting, free of mechanical limitations and disturbance by human agency, is accomplished with the Lectro-Count.

INFORM-A-GRAM KEY No. G93-L

SUB-LAND DRILLS for drilling holes to take either flat fillister or flat head machine screws are featured in a bulletin by MOHAWK TOOL CO., Dept. T-5, 21647 Dequindre Rd., Hazel Park, Mich. These tools are used for drilling, countersinking, and counterboring parts to accommodate standard machine screws and countersink head rivets, or they replace conventional center drills. Thus in one operation, this drill eliminates the use of the second drill, countersink or counterbore. It can be used on drill presses, multiple spindle drill heads, automatic drilling or screw machines, and electric or air powered hand drills, etc.

INFORM-A-GRAM KEY No. B88-L

CARBIDE TIPPED DRILLS & REAMERS for speeding-up production are illustrated, explained and priced in a folder by GORAL TOOL CO., Dept. T-5, 5020 E. McNichols Rd., Detroit 12, Mich. Included herein are drills for hardened steel drilling without annealing; twist drills with cutting edges made to withstand long periods of use at extremely high speed operation; hardened flute and shank reamers known for holding their sizes through long periods of use; and masonry drills which drill from 50 to 75 percent faster and last up to 50 times longer than ordinary steel drills.

INFORM-A-GRAM KEY No. E10-L

ALLEN SQUARE HEAD SET SCREWS, milled from bar Allenoy steel and usable wherever maximum strength is essential, are introduced and priced in a catalog by THE ALLEN MFG. CO., Dept. T-7, Hartford, Conn. Stocked in dog and cup point models, these screws have die cut threads produced by an exclusive Allen method. Each of these screws is visually and manually inspected to ensure their 100 percent uniform quality. Other literature obtainable explains the Allen Vest-Pac-Kit of six hex keys, three of which fit set screws, the other three fit cap screws.

INFORM-A-GRAM KEY No. 182-L

SAFETY WEDGE GRIP STAMPS and interchangeable Steel Type Holders are featured in bulletin WG-462 issued by M. E. CUNNINGHAM CO., Dept. T-8, 104 E. Carson St., Pittsburgh 19, Pa. This bulletin also illustrates and describes multiple character stamps for either straight or curved line, convex, and concave surface marking. The interchangeable steel type holders are usable wherever fast character changing is required. Cunningham company's MECCO "safety" steel eliminates mushrooming and spalling, while for stamping operation use, positive grip is assured by the "wedge grip" feature.

INFORM-A-GRAM KEY No. 170-L

OPTICAL FLATS for light wave, highly accurate measurement of flatness on seal rings and similar parts are featured in bulletin 453

by ACME SCIENTIFIC CO., Dept. T-8, 200 North Laflin St., Chicago 7, Ill. This bulletin contains the most extensive listing available of stock sizes of optical flats, both single and double surfaced. The flats are procurable in optical glass, Pyrex, and fused quartz; their diameter sizes are from 1" to 10"; in grades of accuracy they range from 1 to 10 millionths inch (1 fringe to 1/10th fringe).

INFORM-A-GRAM KEY No. H52-L

MILWAUKEE SURFACE PLATES, angles, and box parallels are all illustrated, fully described, and priced in bulletins published by J. C. BUSCH CO., Dept. T-4, E. Pittsburgh Ave. and S. Ferry St., Milwaukee 4, Wis. Very fine hard iron, rigidly designed, is used for Milwaukee Surface Plates. They are roughed out, annealed, finish planed, and finally scraped to insure their accuracy of surface flatness. For modern production, inspection, and laying out of tools with essential accuracy, these accessories are indispensable.

INFORM-A-GRAM KEY No. 94-L

LUCIFER ELECTRIC FURNACES serve for hardening, drawing, tempering, and annealing or normalizing of dies, punches, gage and fixture parts, and everything else within their range of muffle sizes. They are featured in a folder by GILBERT S. SIMONSKI, Dept. T-5, 401 N. Broad St., Philadelphia 8, Pa. Lucifer furnace automatic heat control is stepless anywhere within its range of up to 2000° F. Besides the three models for practically all average needs shown herein, other furnaces adapted to fit specific needs are devised by their maker's engineering department.

INFORM-A-GRAM KEY No. H57-L

PLUG GAGES AND PIN SETS are the subjects of several bulletins recently issued by UNITED PRECISION PRODUCTS CO., Dept. T-2, 3524 W. Belmont Ave., Chicago 18, Ill. DubLife precision plug gages are made of the finest gauge steel, either Uppco lapped or chrome-plated and Uppco lapped. Their modern, lightweight, and perfectly balanced handles feature green go, and red no-go collets of light, tough plastic. Each plug is reversible. When, after long service, either plug is worn, it is simple to remove it from the handle, reverse it end for end, then reinsert in the handle.

INFORM-A-GRAM KEY No. 503-L

RAPID DESIGN TIME SAVERS or instruments for laying-out drawings are announced in new literature by RAPIDESIGN, INC., Dept. T-3, P. O. Box 592, Glendale, Calif. These instruments serve for drawing elliptical as well as other forms; standard detailing; and executing either electrical or architectural symbols. They are accurately made of transparent, drafting instrument quality plastic sheets, clean cut and carefully finished. RapiDesign instruments are invaluable for the use of draftsmen, design engineers, architects, production illustrators, ad-layout and other artists, students, inventors, schools, etc.

INFORM-A-GRAM KEY No. H66-L

MACHINE TOOLS FOR INDUSTRY are described, illustrated and listed and all their specifications are given in catalog G-3-2 N. P. by the WALKER-TURNER CO., Dept. T-9, Plainfield, N. J. These metal working machine tools include: 14" and 16" metal cutting band saws and blades; belt and disc surfacers; single and multiple spindle, bench and floor model drill presses; grinders, geared and motor driven by 1, ½, and ⅓ hp; variable speed drive polishing lathes, both bench and floor models; motors; transmission equipment; and V belts and pulleys.

INFORM-A-GRAM KEY No. 512-L

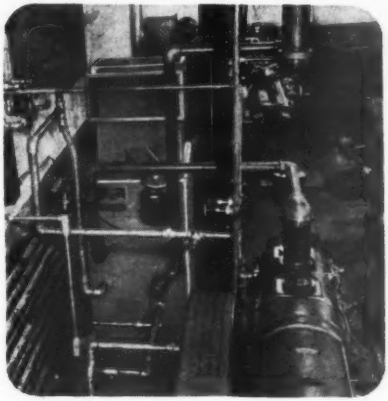
HEAVY DUTY PLAIN GRINDERS with spring mounted separate motor drives and available in four bench models are announced in a folder by CRYSTAL LAKE GRINDERS, Dept. T-4, Crystal Lake, Ill. The separate drive tends to keep the motor out of the dirt and eliminates vibration. This cylindrical grinder has a table travel capacity of from 4" to 8"; spindle speed to 3200 rpm; and head stock changeability to four work speeds which renders it ideal for small bench lathe work. The wheel of 6" in dia with a 1¼" hole can be used with a face of from 1/16" to ½". Small and medium size parts are ground to a high degree of accuracy in size and roundness as well as producing a mirror finish.

INFORM-A-GRAM KEY No. H67-L

GUN-FIL LUBRICATORS, virtually grease cups filled by means of a grease gun, are used for bearings, providing them with uniform, predetermined, and systematic lubrication. Gun-Fils are introduced in a bulletin by GRAY CO., INC., Dept. T-9, 1220 W. Randolph, Chicago, Ill. Dependable and thoroughly tested Gun-Fils lubricators are made in four sizes, to handle bearings ranging from 50 sq in. in area to 250 and 400 sq in. in area; Graco Gun-Fils are used with grease or high viscosity oils.

INFORM-A-GRAM KEY No. H68-L

Niagara Aero After Cooler Protects Air Processes from Moisture Damage



Industries requiring dry compressed air need the Niagara Aero After Cooler. It provides cleaner, drier air for pneumatic tools, spray guns, sand and shot blast equipment, air cleaning nozzles and situations where air is introduced into materials in process.

The Niagara Aero After Cooler is based on the evaporative cooling principle. It does not consume cooling water and thus pays for itself quickly from savings in water bills. The patented "Balanced Wet Bulb" method assures the lowest air temperature, and controls exactly the jacket water temperature.

Write for Niagara Bulletins 96 and 98 for further information

NIAGARA BLOWER COMPANY

Over 30 Years of Service in Industrial Air Engineering

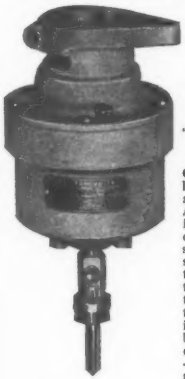
Dept. TD-56, 6 East 45th Street, New York 17, N. Y.

Field Engineering Offices in Principal Cities

NIAGARA

AIR ENGINEERING EQUIPMENT

Sensitive Tapping Head for Fast, Accurate Tapping



"TRU-GRIP" TAP HOLDER

The new "Tru-Grip" is a smaller, lighter and more accurate tap holder. A broached section in the chuck receives the flattened surfaces on the spring collet, while the tap has a positive drive through the square hole in the collet. The tap is held in alignment by the round and driven by the square — taps are never scored.

★Cover clamping eliminates chatter

★Rigid mounting reduces vibration

The Procunier cover clamping tapping head clamps directly to the drill press quill for greater rigidity and freedom from chatter. Vibration and the tendency to "run-out" or "bell mouth" is minimized. Procunier Hi-Speed Tap Heads are precision built for accurate tapping at high speeds. Driven by a cork-faced friction clutch, the tap is protected by a soft "cushion" effect. Operators quickly detect the presence of a dull or "loaded" tap by the amount of pressure needed to drive the tap. The clutch instantly slips should the tap strike bottom or stick due to tap loading.

FAST, ACCURATE EXTERNAL THREADING WITH ACORN DIES

Do external threading jobs faster with a Procunier Tapping Head which holds standard Acorn dies. Cut external threads quickly in brass, die castings and aluminum.

PROCUNIER SAFETY CHUCK CO.

12-14 S. Clinton St. Chicago 3, Illinois

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Send me bulletins on ( ) Procunier High Speed Tapping Heads ( ) Tru-Grip Tap Holders ( ) Universal Tapping Machines

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PUBLICATION PREVIEWS

EVEREDE TOOLS or jig and lathe boring bars, their holders, and tool bits are featured in a new catalog by EVEREDE TOOL CO., Dept. T-6, 2000-02-04 N. Parkside Ave., Chicago 39, Ill. The clamping pressure, which is distributed over a large area of the tool bit, accounts for the Everede boring bar being an extremely accurate tool holder. It is extensively used for precision thread cutting. The Everede solid tungsten carbide triangular tool bits are furnished in different grades and four sizes. Any one of the boring bar holders is adjustable for use on various sizes of lathes and to accommodate various size boring bars.

INFORM-A-GRAM KEY No. 958-L

MAGNETIC HOLDING METHODS are described in detail and clearly illustrated while the power grip chucks and magnets used in their make up, are cataloged in a new booklet by ROCKFORD MAGNETIC PRODUCTS, Dept. T-5, 1302, 18th Ave., Rockford, Ill. With so many of the most serious time losses in machining operations being related to material holding, reducing the time required to locate and secure work on the machine presents great possibilities for production improvement. This booklet is a practical aid to all those trying to better the output of men and machines in their plants.

INFORM-A-GRAM KEY No. A87-L

UNISTRUT FRAME STRUCTURES for practically every type of storage, framing or work table construction, are assembled merely with lock-spring nuts, and use of wrench and hack saw. They are introduced in a late bulletin by UNISTRUT PRODUCTS CO., Dept. T-7, 1013 Washington Blvd., Chicago 7, Ill. Among the countless items they store, Unistrut structures hold dies, bar stock, and merchandise. They are also used to construct kick press tables, machinery supports, work horses, and even portable or stationary tables for material handling. Worth remembering too, is that all-purpose metal framing Unistrut is 100 percent re-usable.

INFORM-A-GRAM KEY No. E65-L

COLD TREATING PRACTICE is well explained and illustrated in a new booklet being distributed by DEEPFREEZE, Dept. T-7, North Chicago, Ill. Though used but a relatively short time for industrial purposes, this application of cold treating has proven to be extremely valuable. It has been advantageously used in a wide variety of industries for hardening, stabilizing, testing, and shrinking of metals and other materials. This booklet gives a complete and detailed account of the cold treating process from its inception to present stage of development.

INFORM-A-GRAM KEY No. H64-L

SPEED-DRAF DRAFTING BLOCKS of high grade tracing paper with the most commonly used scales always in position are introduced in a folder by EFFCO PRODUCTS, Dept. T-5, 10004 Carnegie Ave., Cleveland, Ohio. Each block contains 75 sheets of highly transparent tracing paper, the three conveniently printed scales being ⅛", $\frac{1}{16}$", and isometric on ⅛". By use of the Speed-Draf block, sketches may be made to scale without rulers, T-squares, or need of measurement. Such provision for accurate sketching and drawing, either in the drafting room or field, saves immeasurable time.

INFORM-A-GRAM KEY No. H63-L

A CARBIDE TOOL GRINDER, Model 50-A, can also be used for wet or dry grinding of other types of tool bits when keen and accurate cutting edges are required. Model 50-A is introduced in a brochure by WILLEY'S CARBIDE TOOL CO., Dept. T-2, 1340 W. Vernor Highway, Detroit 1, Mich. This grinder uses 6" grinding wheels with a steady flow of force fed coolant insuring cool cutting action. Tool bits of up to 2" in size, either square or in cross section, may be rough, semi-finish, or finish ground by Model 50-A tool grinder.

INFORM-A-GRAM KEY No. 551-L

FLOATING BALL HYDRAULIC WORK HOLDERS and positioners provide operators with entire use of their hands for countless jobs included in repairing, inspecting, and assembling. These Powrarm holders are featured in new literature by THE GARFIELD ENGINEERING CORP., Dept. T-9, Kansas City 6, Mo. Articles of up to 150 lbs in weight are held by the Powrarm which utilizes various handy and easily changed adapters. By providing easy access to every side of the article it sustains, this work holder both speeds production and lessens its cost.

INFORM-A-GRAM KEY No. H62-L

A DRY CYANIDING PROCESS, applicable to the problem of providing a case on low carbon carburizing steel without its being embrittled or excessively distorted, is explained in a new folder by PERFECTION TOOL AND METAL HEAT TREATING CO., Dept. T-3, 1740 W. Hubbard St., Chicago 22, Ill. By use of this process, case depths of up to .025" (of true carbon combined with nitrogen) and hardness exceeding 60 Rockwell C are readily

A Few Good Reasons Why You Should Protect "Precision" With

"Toolcoat"

1. "Proven Performance" say many users who have already installed this modern method of protection for precision, carbide tools, gages and spare parts.
2. Cost is negligible compared with previous methods of rust proofing and wrapping.
3. Superior protection against breakage, corrosion and long time storage.

"TOOLKOTER"

1. Simple application with newly developed "Tool Koter," readily portable, weighing only 50 lbs., engineered to meet all your tool coating requirements.
2. Low wattage, can be plugged in ordinary socket, all welded steel construction, heavy duty automatic thermostat, thoroughly insulated.
3. Price of "Tool Koter" only $67.50, includes special heat transfer oil — ready to operate.

If you are already using this method of protection, investigate "Tool Coat" for best results — meets all Government specifications. Prompt Delivery.

Write for details. Let us submit recommendations without obligation.

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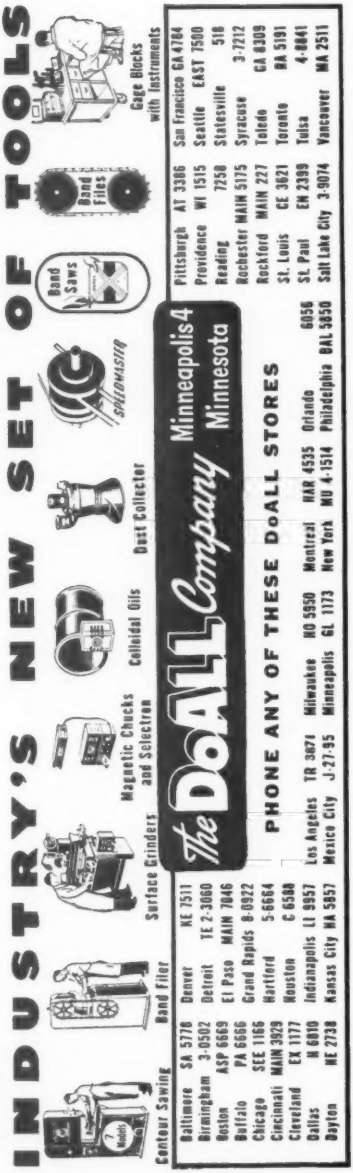
CHICAGO 2, ILL.
Phone Andover 5292

Write us for name of nearest representative.

INDUSTRY'S NEW SET OF TOOLS



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Buffalo	PA 6666	Grand Rapids	8-0922	Omaha	JA 2-3151	Peoria	3-7831	Richmond	3-8291	Reading	7258
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Cincinnati	MAIN 3929	Houston	C 6388	Seattle	EAST 7500	Statesville	518	Syracuse	3-7212	Toledo	GA 8309
Cleveland	EX 1177	Indianapolis	LI 9957	St. Louis	CE 3621	Toronto	RA 5191	Tulsa	4-8841	Vancouver	MA 2511
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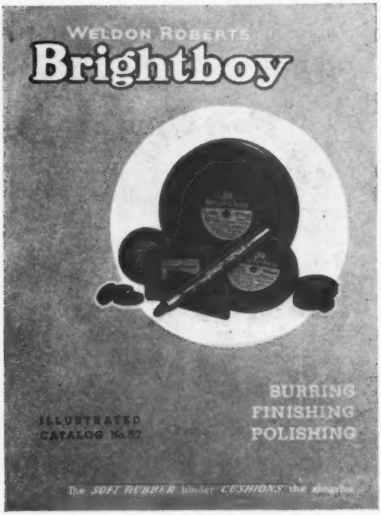
obtainable. To demonstrate the superiority of this process, the company will, for a limited time, treat samples gratis.

INFORM-A-GRAM KEY No. D32-L

BURRING, FINISHING, AND POLISHING WHEELS are the subject of Brightboy Catalog No. 57, a guidebook for saving time, production steps and reducing the cost of finishing



metal, plastic, and wood or other material. Catalog No. 57 is issued by the Brightboy Industrial Div. of WELDON ROBERTS RUBBER CO., Dept. T-5, Newark 7, N. J. Herein, the text and actual use illustrations explain many industrial applications of Brightboy rubber cushioned abrasives. There is also included a large amount of data essential to all modern product finishing.

INFORM-A-GRAM KEY No. 668-L

HY-DRAULIC OPENSIDE PLANERS are the subject of a new bulletin, No. 250, issued by the ROCKFORD MACHINE TOOL CO., Dept. T-4, Rockford, Ill. The planer's design, construction, and operation are herein so thoroughly outlined, the shopman reading about them can well judge their advantages for his own use. Bulletin No. 250 presents detailed specifications of the Rockford Openside Planer in the four rated sizes, each being available with any one of five different stroke lengths ranging from ten to twenty feet.

INFORM-A-GRAM KEY No. E18-L

TOOL & PRODUCTION MILLERS, of the bench type with the same features as larger and more expensive machines, are explained in a new folder by AIRCRAFT MACHINERY CORP., Dept. T-6, Burbank, Calif. Like the largest milling machines, this one is a bed type. It also has a rise and fall spindle and weighs 320 lbs, stripped. Easily changeable from tool to production milling, the versatile Armor Miller performs many lathe operations. With its complete line of accessories, this miller handles horizontal, vertical, and jig bore work.

INFORM-A-GRAM KEY No. 176-L

ENGINEERED LIVE CENTERS are completely described in a four-page catalog recently issued by STURDIMATIC TOOL CO., Dept. T-3, 5220 Third Ave., Detroit 2, Mich. This catalog gives specifications and prices of Standard models incorporating Morse Tapers, and includes details of three special type Sturdimatic Live Centers. Herein illustrated are also over forty other Special live centers which were engineered for specific metal working operations. A properly engineered live center is so fundamental a requisite of job setting-up, its production requires the experience of specialists such as Sturdimatic Tool Co.

INFORM-A-GRAM KEY No. 478-L

A SALSBURY AUTOMATIC CLUTCH FOLDER, Bulletin No. 4501 which describes their new Models 300 and 600, is now available from SALSBURY MOTORS, INC., Dept. T-4, 4464 District Blvd., Los Angeles 11, Calif. With its centrifugal action, the Salsbury Automatic Clutch progressively applies power to the driven machine or permits it to idle at a predetermined rpm. This completely automatic device engages and disengages a drive mechanism with increase or decrease of engine speed. For handling overload starting, it is highly effective when used with a motor of just normal operating horsepower.

INFORM-A-GRAM KEY No. G70-L

CAST-TO-SHAPE Tool Steels for manufacturing dies, forming tools, gauges, hobs, rools, and many other products are thoroughly explained in a new brochure by JESSOP STEEL CO., Dept. T-7, Washington, Penna. The saving of time, labor, material and machining cost is effected by use of Jessop Cast-To-Shape Tool Steels. The most pronounced savings in the construction of cast-to-shape tool steel dies is the minimum finish machining

for SPRINGS

made to precision standards for instruments, dies and tools—specify GIBSON, product of 75 years specialized experience. Scientifically designed for the work they are to do, made to exact specifications, heat treated and thoroughly tested, they function more accurately, last longer, save time in assembly and adjusment, reduce spoilage, cut costs all around. Investigate! Write us about your requirements.

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(DIVISION OF ASSOCIATED SPRING CORPORATION)

MEASURING A PLUG GAGE WITH LIGHT WAVES

using an optical flat, a toolmakers flat and a gage block

The formula is:

$$D = h + \left(.000012 \times N \times \frac{W}{w}\right)$$

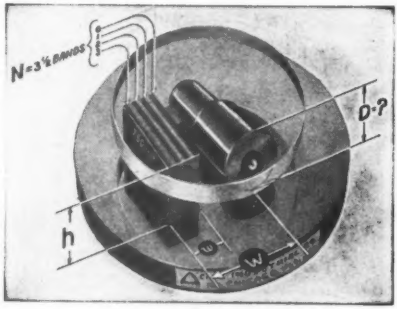
Substitute the actual values

$$D = .750 + \left(.000012 \times 3\tfrac{1}{2} \times \frac{1\ 7/16''}{23/64''}\right)$$

and get the answer

D = .750168 inch.

It's just that simple!



Write for new, free Lightwave Measurement Booklet.

ACME INDUSTRIAL COMPANY

SCIENTIFIC DIVISION

Makers of Standardized Jig and Fixture Bushings

206 N. Laflin St. Chicago 7, Ill. MONroe 4122

required. Always furnished in annealed condition, these steels greatly facilitate machining and grinding.

INFORM-A-GRAM KEY No. 259-L

SUPERSONIC REFLECTOSCOPES for scientific testing and measuring of materials are introduced in bulletin 3000 by SPERRY PRODUCTS, INC., Dept. T-9, Hoboken, N. J. This bulletin briefly outlines the operation and application principles of the Supersonic Reflectoscope. Modern industry recognizes the importance of testing raw stock, constantly checking material during production, and finally inspecting finished products. All these procedures are simplified by the wide range of application, portability, and visual indicating of the Supersonic Reflectoscope.

INFORM-A-GRAM KEY No. G85-L

LINDBERG PRODUCTION BRAZING FURNACES for continuous service are explained in bulletin 210, distributed by the LINDBERG ENGINEERING CO., Dept. T-7, 2450 W. Hubbard St., Chicago 12, Ill. Work varying from high temperature copper brazing to bright annealing and sintering of powder metals is handled by the Mesh Belt Conveyor furnaces with their effective temperature ranges of from 1300 to 2100° F. Roller Hearth Production furnaces of the same temperature range accommodate loads of up to 2500 lbs net ph, or those too heavy for mesh belt conveying. Hydryzing or neutral atmosphere heat treating is also explained herein.

INFORM-A-GRAM KEY No. 369-L

DRILLING HOLES OF SQUARE, hexagonal, octagonal, and triangular shapes is easily accomplished with Watts Angular Drills and Full Floating Chucks. They are featured in a pamphlet lately issued by WATTS BROS. TOOL WORKS, Dept. T-3, Wilmerding, Pa. Engine or turret lathes, drill presses or hand screw machines empower the drills and chucks for handling this angular work. Upon completion, these blind or open angular holes are commercially true to size and shape with a smooth finish. The saving of time in the use and the low first cost of these efficient tools, make them a profitable investment.

INFORM-A-GRAM KEY No. H41-L

BELT SANDING OF METAL with The Polishing Lathe in bulletin No. 4, and Testing Coated Abrasives in bulletin No. 3 are procedures well described by the CLOVER MFG. CO., Dept. T-9, Norwalk, Conn. They are now publishing monthly technical bulletins embracing all the new technique, new methods, and new sanding machinery which has been developed through promotion of the war effort. Other literature available concerns Coolants for Abrasive Belts and, for all manufacturers, timely suggestions intended to help solve their immediate problems of reconversion.

INFORM-A-GRAM KEY No. E34-L

YOUR PRODUCTION PROBLEMS are discussed and suggestions for their solution are offered in an eight-page brochure by HYDRAULIC MACHINERY, INC., Dept. T-2, 12825 Ford Rd., Dearborn, Mich. Besides completely outlining this company's greatly expanded facilities, this brochure describes the engineering, laboratory, and production departments and illustrates typical examples of special and hydraulic machinery as well as test equipment and hydraulic power units. Concerning each phase of this firm's service, more detailed information is also available.

INFORM-A-GRAM KEY No. 32-L

MAGNESIUM ALLOYS used in the composition of Dowmetal are the subject of a catalog published by THE DOW CHEMICAL CO., Dept. T-7, Midland, Mich. Contained herein are descriptions of the present role of Magnesium Alloys with their uses and advantages; tables showing the various Dowmetal compositions, their physical constants and specifications, besides the Dowmetals recommended for specific metal forming purposes. These include the making of castings, forgings, extruded parts, plate, sheet and strip metal. This text and the accompanying tables give the designer a general conception of magnesium's nature and uses.

INFORM-A-GRAM KEY No. 275-L

MULTI-DRILL HEADS, for equipping any standard, single drill press to simultaneously drill as many as six holes, are the subject of bulletin No. 945 published by COMMANDER MFG. CO., Dept. T-4, 4221 W. Kinzie, Chicago 24, Ill. Adjustable to suit any multiple hole pattern, these drills not only save man and machine hours, floor space, and machine tool investment, by multiplying the output of single spindle drill presses, they also greatly reduce production costs. These nominally priced, universal in application Multi-Drills require neither special tools nor alteration for quick attachment to most drill presses.

INFORM-A-GRAM KEY No. F35-L

More Accuracy With OLIVER DIE MAKER

DIRECT SAVING IN LABOR
50% to 66%
over hand methods

OLIVER OF ADRIAN PRODUCTS

●The Oliver of Adrian Die Making Machine is an All-Purpose Tool. It is extremely Fast and Accurate on *Sawing, Filing* and *Lapping* operations — in making dies, gages, templates and stripper plates — every shop should have 2 or more Oliver Die Making Machines.

Don't Neglect Your Toolroom It's the Backbone of Production!

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AUTOMATIC DRILL GRINDERS—TOOL AND CUTTER GRINDERS—DRILL POINT THINNERS—TEMPLATE TOOL GRINDERS—FACE MILL GRINDERS—DIEMAKING MACHINES

ENGINEERS — PRODUCTION — INSPECTION MEN!
BOOST PRODUCTION and PRODUCT QUALITY — 15 DAY SHIPMENT ON URGENT ORDERS

Curtiss-Wright Corporation ranks our product with *their* best tools. Cleveland Graphite Bronze Company, Leading Bearing Manufacturer, States New High Accuracy Reached, Plus Substantial Production Boosts

WITH

YOUNG ROLLER CLUTCH PRECISION MANDRELS

Patent Pending

Quotations Definitely Moderate

Good Delivery Schedules

No More "C" Washers, Wrenches, Drawbars; No More Arcs or Tapers Before or After Expansion Grip — Concentricity in Low 10,000ths — Production or Inspection.

Assured parallelism of sleeve surface to center line—absolutely no variation in repeated mounting of parts.

Uniform full-work-length friction-locking gives complete control and contact of entire bore surface area—absolutely no variation in repeated mounting of parts—no tapers—Slip part on mandrel with slight counter-clockwise motion, that's all—it's ready—Self-contained, self-expansion, self-locking, self-contraction. Instant unloading, no jamming, no adjusting—Interchangeable sleeves—you do not obsolete Young Mandrels. Built to your bore tolerance high limit, with automatic contraction to low limit—Any mounting—Any machine operation—For bore diameters .718 to 5.5—Reduces tool costs, extra equipment investment, operating costs, maintenance, down time, scrap, salvage.

YOUNG ARBOR CO., 3257 Bradford Road, Cleveland Heights 18, Ohio

DO YOU HAVE A LIFTING AND CARRYING PROBLEM?

Solve it with Portelvator, the Hamilton Portable Elevating Table. No other unit of equipment does so much for so little.

Standard models lift and carry loads up to 5,000 pounds. Special models built to solve "out-size" problems.

Used to lift to desired height for any operation, then smoothly rolled to the next machine and height-adjusted as required. Used as a level under overhanging work; as a portable work bench; to charge and discharge heat treating furnaces. Used in tool room and stock room, in loading and unloading.

Write for descriptive literature today . . . now, while that good impulse holds. (It doesn't cost a cent to find out!) Address Department C.

THE *Hamilton* TOOL COMPANY

SUPER SENSITIVE DRILLING MACHINES
TAPPING MACHINES · PORTELVATORS

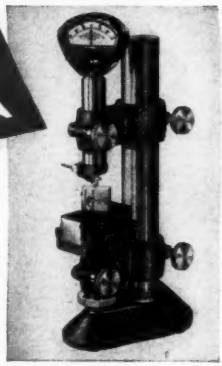
NINTH STREET AT HANOVER · HAMILTON · OHIO · U·S·A

MIKROKATOR

"MIKRO" (MINUTE)

FRICTIONLESS AMPLIFICATION

Positive, Dependable Repeat Readings



NO friction, lag or backlash . . . no racks, pinions, gears, levers, etc. subject to wear. Pointer responds instantly without swinging past true reading. Amplification is 100% mechanical, no lights or electromagnets, no warming up period required. Easily moved to different locations as there are no electrical connections. Our engineering department is at your service for applying Mikrokator to your measuring problem.

WRITE FOR LITERATURE—T.D.J.

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Graduated — 000
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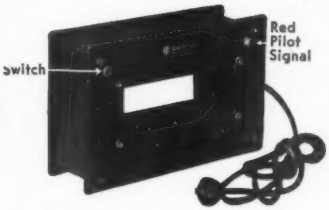
Graduated — .001 mm

SWEDISH GAGE CO., OF AMERICA

8900 ALPINE AVE., DETROIT 4, MICH.

Save TOOLS · TIME · LABOR
with the Improved · AMC · DEMAGNETIZER



No shop or toolroom can afford to be without one. Thoroughness of the AMC Demagnetizer will give greater precision to finished parts.

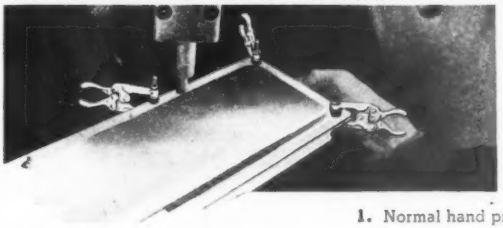
One pass through AMC Demagnetizer removes all magnetism from processed parts. Large flat surfaces are demagnetized by sliding unit over surface.

● **Our AMC Demagnetizer will pay for itself in a few weeks. Standard units available, and special sizes to order.**

▶ ***Write today for illustrated circular.*** ◀

ALOFS MFG. CO.
1619 Madison Grand Rapids, Mich.

ANNOUNCING—NEW TOGGLE PLIERS *by* ***KNU-VISE***



MANY DISTINGUISHING FEATURES INVITE YOUR CONSIDERATION

Known as model P 402—made in four styles—these new Knu-Vise pliers measuring slightly over 4 inches and weighing but 4 ounces can be very efficient in holding work for drilling, welding, assembly, etc.

1. Normal hand pressure of 40 lbs. creates 400 lbs. pressure at working contact. Ratio 10 to 1.
2. Screw driver slot on spindle facilitates adjustment.
3. Curved handles makes closing from extreme open position easier and more comfortable.
4. Pressure is not exerted against adjustment nut but against boss, as the nut is positioned outside of spindle.
5. Definite locking stop provided.
6. Pressure pad is practically flat, holds rubber cap more securely; and doesn't produce depression in work held

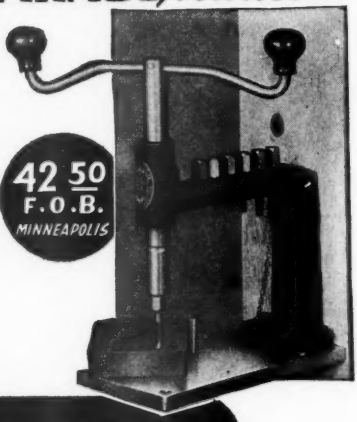
KNU-VISE INCORPORATED

1330 PLUM ST. DETROIT 16, MICH.
4328 SAN FERNANDO RD. GLENDALE, CALIF.

TAP BREAKAGE *Reduced*

Square, Straight Boring in Half the Time

The Dahlstrom Tap Guide practically eliminates tap breakage and saves wasted hours getting broken taps out of expensive dies. It does the job in a jiffy with work always straight and true. Just fasten it to a post or bench, slip a Tap Adaptor into the spindle, and even an inexperienced operator can handle it. Equipped with 7 Adaptors, ranging from 8-32 to ½". Taps not furnished. Ask your mill supply house, or $42.50 F. O. B. Minneapolis. *Literature on request.* **Dahlstrom Manufacturing Co., 422 South Sixth Street, Minneapolis 15, Minn.**



DAHLSTROM MANUFACTURING CO.

Dahlstrom **TAP GUIDE**

NEW GAGE SAVINGS!

SCHNACKE *Adjustable* FLUSH PIN GAGE

With this new adjustable gage, you can have an accurate Flush Pin Depth Gage quickly and save time and money. Serves many varied gaging purposes in production and inspection. Set consists of 3 interchangeable depth rods (1"—2"—3") and 1" diameter sliding anvil, adjustable to required depth. Sliding tolerance feelers at the top are set with micrometer screw from plus or minus .000 to .200. Locks firmly. Standard set applicable to any decimal dimension up to 3.00".

Special anvils and longer rods are also available. Write for descriptive circular.

SCHNACKE, INC.

1016 E. Columbia St. Evansville, Ind.

Accurate, Trouble Free Production

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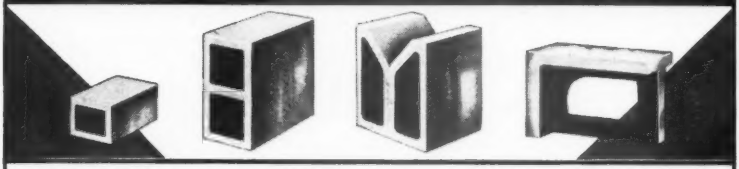
CHALLENGE SURFACE PLATE EQUIPMENT



BOX PARALLELS
Made in 18 sizes from 1½x2x4 to 12x12x24 in.

SOLID PARALLELS
Made in 14 sizes.

V-BLOCKS—7 Sizes
From 4x5x3¾ in. to 8x10x5½ in. These and Companion pieces are all made of fine-grained, special analysis, semi-steel castings.

Challenge 887

UNIVERSAL IRONS
4 Sizes, from 4x5x3¾ to 8x10x5½ in.
Companion pieces—
ANGLE PLATES—
22 Sizes

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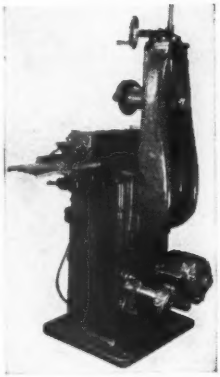

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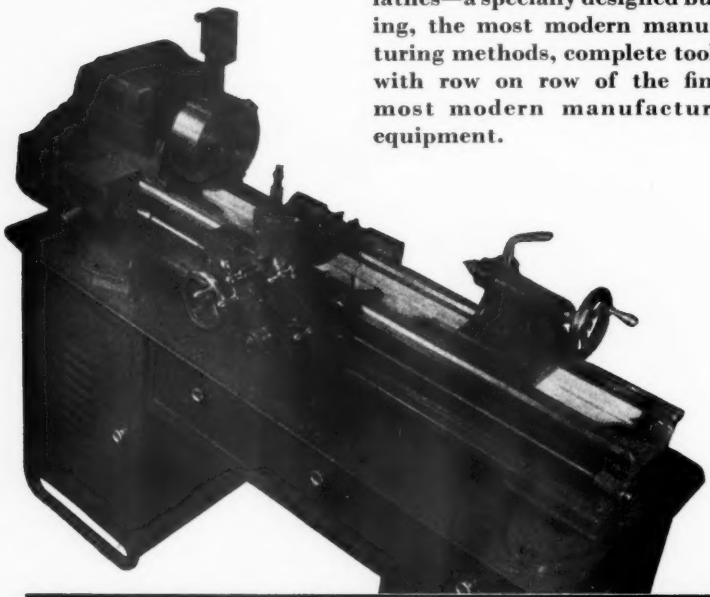

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The slide, which is now being distributed to owners of Apeco Photocopy equipment, is made of high quality varnished cardboard, measures 6" x 3", and holds a movable chart whose figures appear through slots on the front face of the rule. Exposure time is given for five types of reproduction; positive, reflex, reverse alternate, and readable negative.

Further information is available from the American Photocopy Equipment Co., Dept. TJ, 2849 North Clark St., Chicago, Ill.

INFORM-A-GRAM KEY No. 3-L

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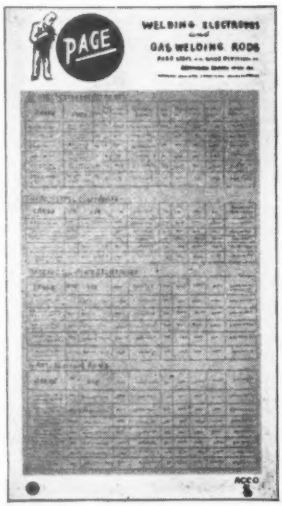
The wire to be stripped is first quickly dipped in one chemical solution, followed immediately by a second quick dip in a final solution that acts as an accelerator. Then, by gently stroking the wire once or twice with two fingers, the insulation is completely removed. The entire procedure takes only a few seconds. In over 1½ years of heavy production, this method has been found to be non-toxic to the employee, and in no way chemically harmful to the wire or finished product.

All manufacturers of electrical and electronic products, such as radios, radar, television sets, electrical household appliances, fractional horsepower motors, hearing aids, recorder and playback systems, etc., will find this method results in an unusually large savings in production costs.

The Fairchild Camera & Instrument Corp., Dept. DJ, Jamaica, N. Y., will furnish additional details.

INFORM-A-GRAM KEY No. H50-L

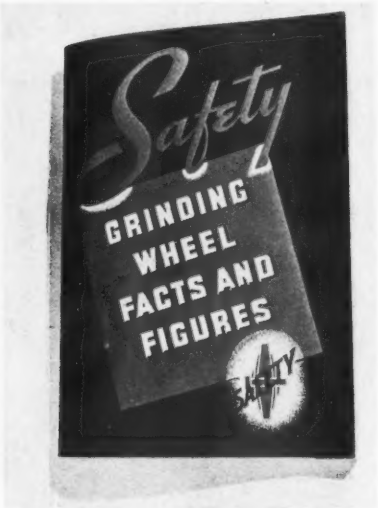
ELECTRODE PROPERTIES CHART. This reference chart gives the chemical and physical properties of all the Page welding electrodes and gas welding rods. A tremendous amount



of welding data is clearly condensed and arranged for easy fact-finding. The chart is 17" x 25½" and can be hung on the wall or folded down and filed in a desk drawer.

This chart will prove very valuable in the

welding shop as well as in the office of the welding engineer. It should also prove to be important to the welding superintendent, general engineer, metallurgist and purchasing agent.



Write to Page Steel & Wire Division, American Chain & Cable Co., Inc., Dept. DJ, Bridgeport 2, Conn., and refer to Wall Chart DH-1314, or use our

INFORM-A-GRAM KEY No. 185-L

"SAFETY GRINDING WHEEL FACTS AND FIGURES" is an illustrated, informative reference booklet for plants with grinding problems. It contains information on the selection of the proper wheel for the job, how to obtain better grinding results, standard types of wheels, causes of unsatisfactory finishes and suggestions for corrections, handy reference tables, and many other useful facts on grinding.

Copies of this 108-page, pocket-size catalog No. W-45 are available from The Safety Grinding Wheel & Machine Co., Dept. DJ, Springfield, Ohio.

INFORM-A-GRAM KEY No. G60-L

"METAL MAGIC", a full color sound movie, demonstrates the versatile accomplishments of the modern induction heater. Induction heating, when properly applied, offers industry a remarkable tool for surface hardening, annealing, brazing, soldering, melting and heating for forging because it produces high-intensity, controlled heat without inflammable gases.

This 16mm film runs for 12 minutes and the speed of operation and ease of control of the unit is emphasized by the fact that an unskilled girl is demonstrating the heater, much to the amazement of the swarthy blacksmith from the old school.

Prints of this film are available from the advertising department of Allis-Chalmers Mfg. Co., Dept DJ, Milwaukee, Wis.

INFORM-A-GRAM KEY No. 183-L

NEW "BLUE SHEETS" OF REFERENCE DATA are now available on Allegheny stainless steel castings, Types 347 and 321, Type 416, and Ludlum 609 shock resisting steel for tools and machine parts. These file-size sheets contain reference data on the physical properties, corrosion and oxidation resistance, effects of elevated temperatures, and heat treating procedures and results. This data, certified by the Allegheny Ludlum technical staff and prepared from carefully checked laboratory and service tests, is in condensed form for quick reference.

Copies of these sheets may be obtained from Allegheny Ludlum Steel Corp., Dept. DJ, Brackenridge, Pa.

INFORM-A-GRAM KEY No. 678-L

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Copies of the catalog may be obtained from The Chemical Publishing Co., Dept. DJ, 26 Court St., Brooklyn 2, N. Y.

INFORM-A-GRAM KEY No. 862-L

"THE MILLER THAT USES ITS HEAD". Unlike many technical films, this is not a "how-to-operate" film, but an analysis of the Nichols Hand Miller from the tool engineer's and tool designer's point of view. This 16mm color and sound movie runs 23 minutes, and is one of the first films to deal directly with tool and fixture design. It shows many different kinds of tooling and fixture design, all the way from simple stock fixtures to completely automatic fixtures, such as one for planing a double-start helix on a fuel injector plunger.

Requests for showings of this film should be addressed to Nichols-Morris Corporation, Dept. DJ, 44 Church St., New York 7, N. Y.

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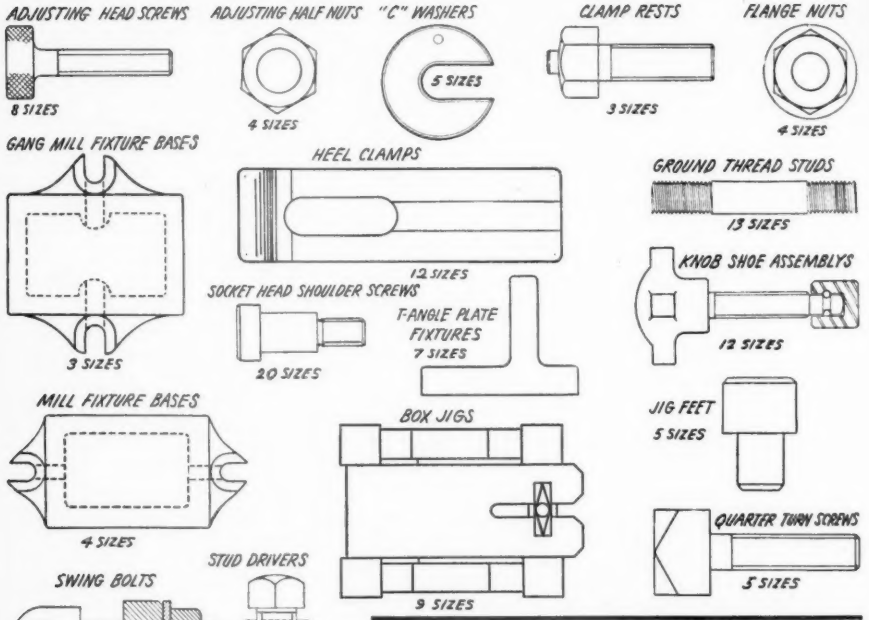

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HIGH SPEED MOTOR—1/30 H P—Universal motor, equipped with self-aligning sleeve bearings, provides speeds from 2,000 to 15,000 R. P. M.

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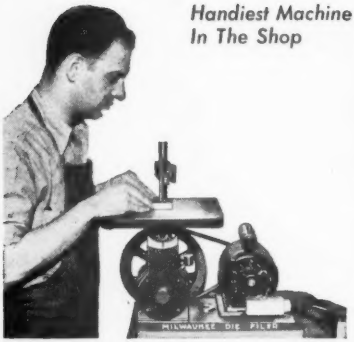

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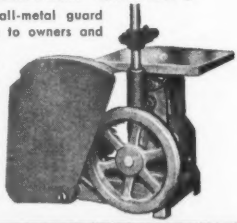

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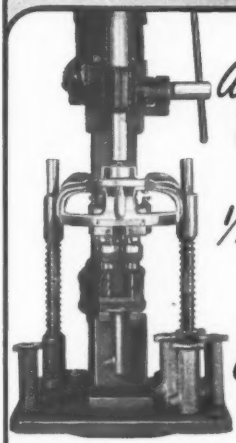

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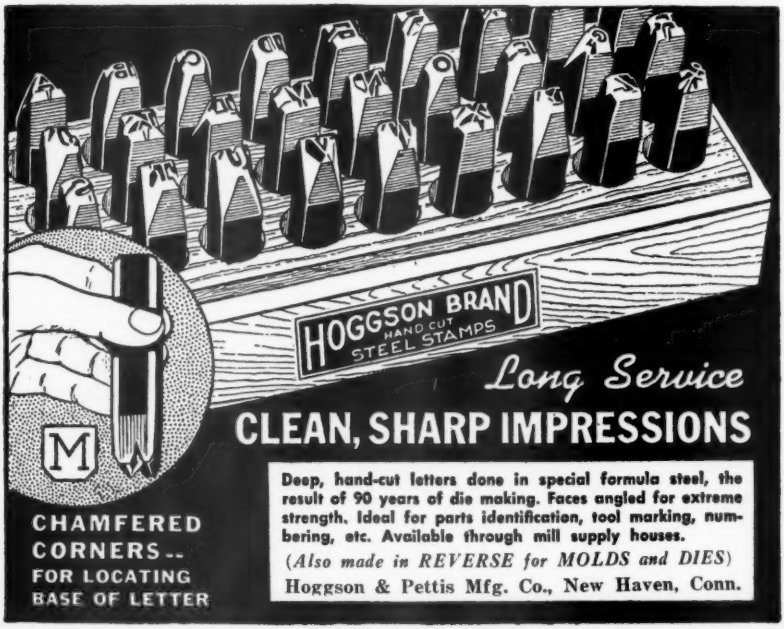
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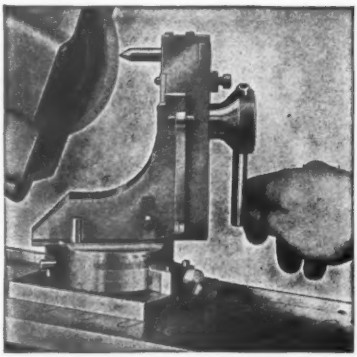

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3/32	7/8	3	3/32	2.50
7/64	7/8	3	7/64	2.25
1/8	7/8	3-1/2	7/64	2.00
9/64	7/8	3-1/2	1/8	2.50
5/32	1	4	9/64	2.50
11/64	1	4	5/32	2.50
3/16	1-1/8	4-1/2	11/64	2.50
13/64	1-1/8	4-1/2	3/16	3.00
7/32	1-1/4	5	13/64	3.00
15/64	1-1/4	5	7/32	3.00
1/4	1-1/2	6	15/64	3.00
17/64	1-1/2	6	1/4	3.25
9/32	1-1/2	6	17/64	3.25
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1/4	1-1/2	6	15/64	3.30
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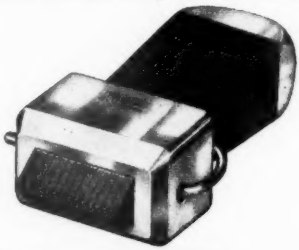

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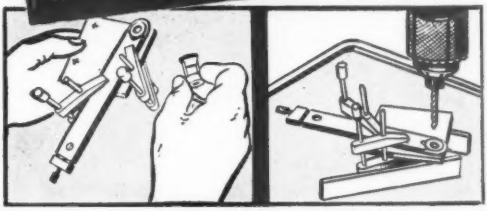

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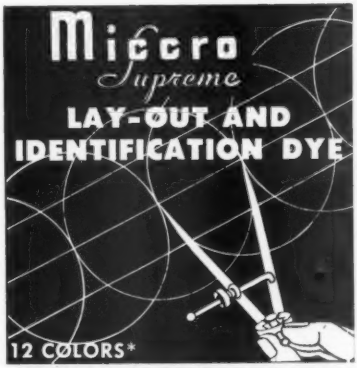

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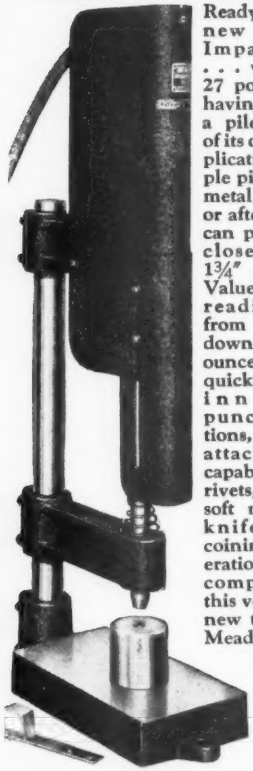

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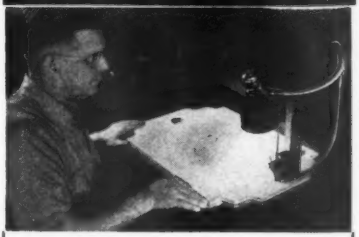

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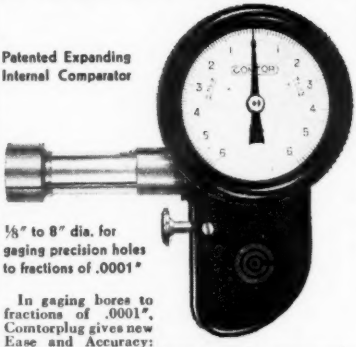

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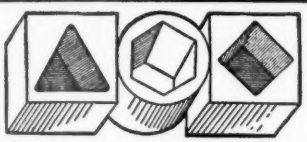

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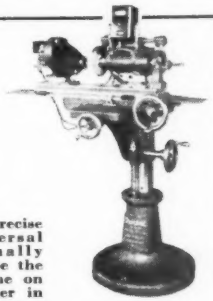

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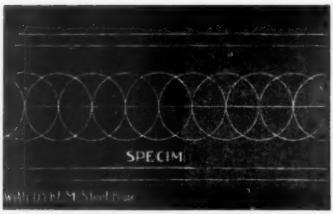

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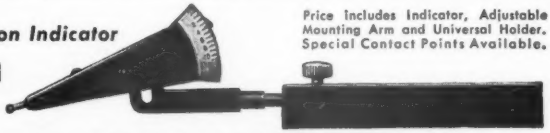

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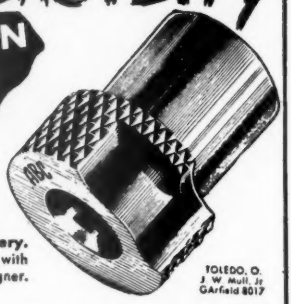

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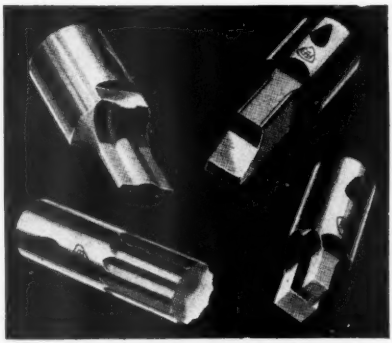

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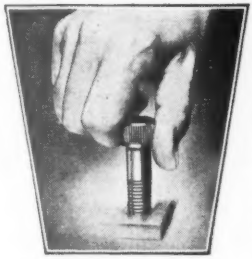

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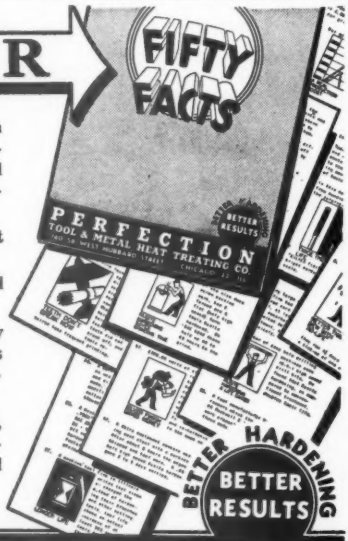

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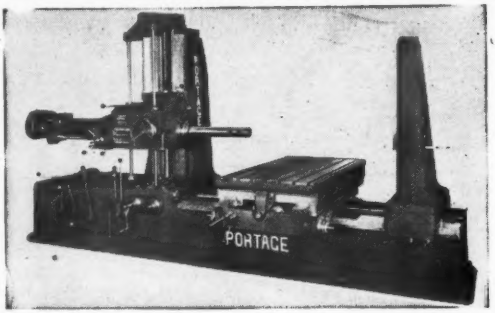

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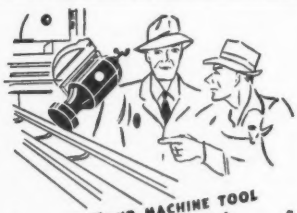

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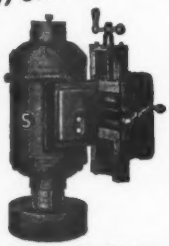

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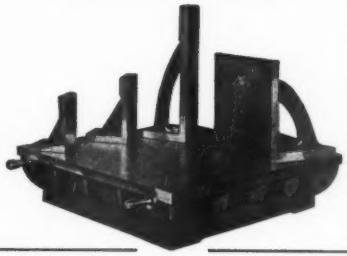

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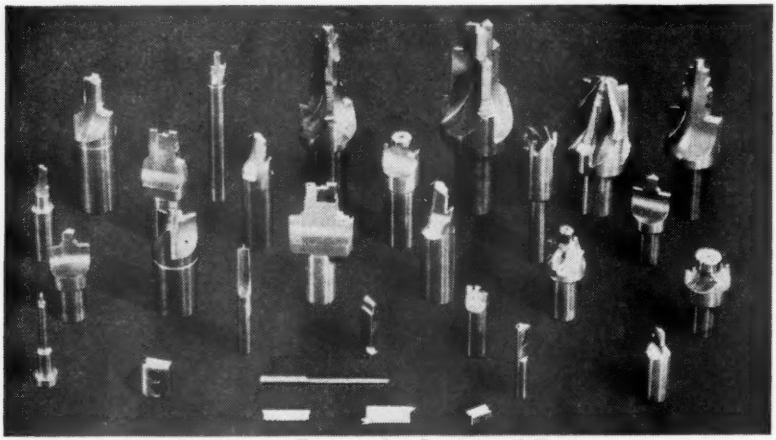

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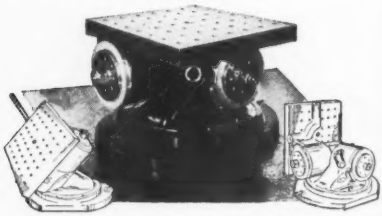

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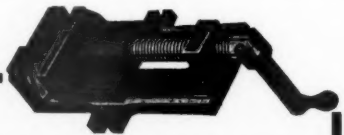

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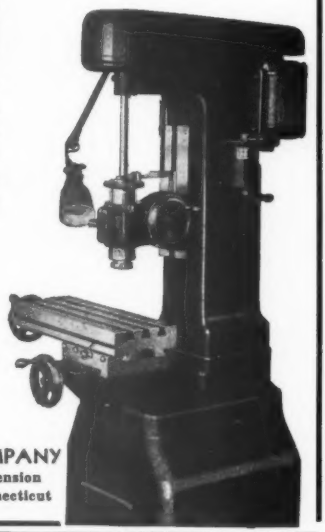

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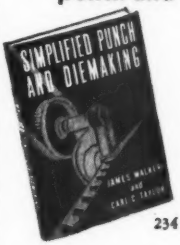

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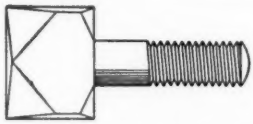

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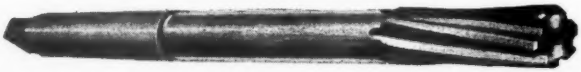

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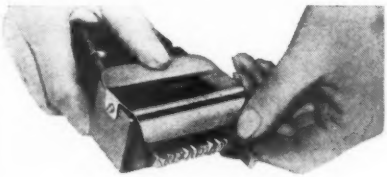

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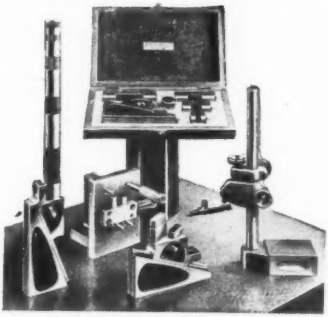

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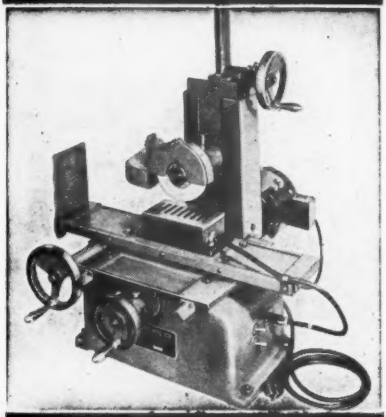

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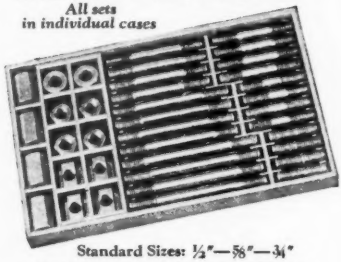

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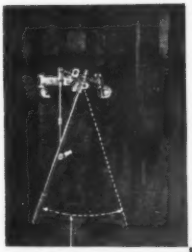

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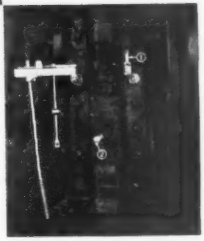

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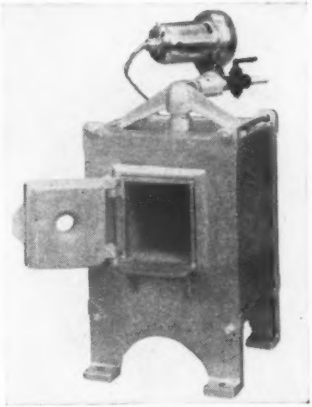

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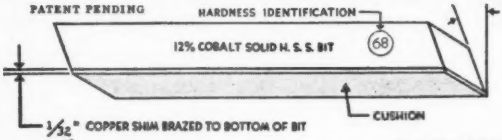

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1/2	1/2	4	2.00	1.95	1.90
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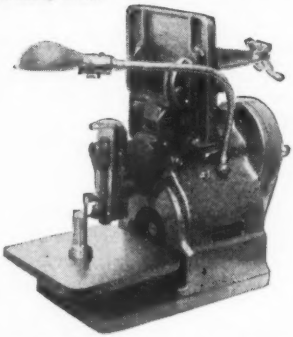

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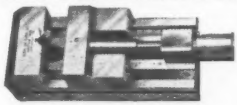

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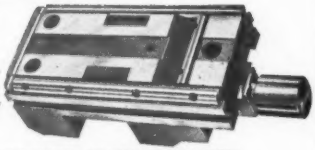

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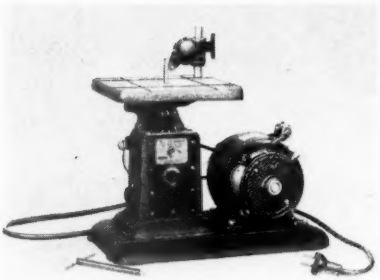

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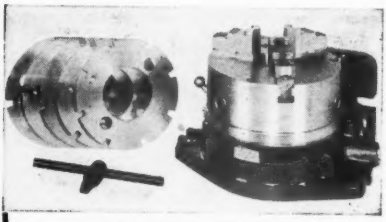

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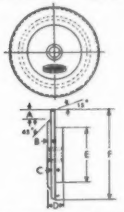
UP TO 500% **MASTERFORM** MASTERCASED LONGER LIFE

GROUND CIRCULAR CUT-OFF TOOLS

FOR BROWN AND SHARPE Screw Machines. Made in special-to-order and stock sizes (see below), ready for prompt shipments.

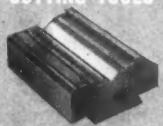
Masterform cut-off tools are made from specially selected high speed steel, carefully hardened and ground to a high polish. Mastercasing, the Masterform process of super-heat-treating, assures more production and 500% LONGER LIFE.



Designed to cut off .005 past center with 1/64 corner break.

ORDER BY GAUGE NO.	FOR USE ON MACHINE NO.	STOCK DIA.	A	B	C	D	E	F	PRICE EACH
00-30	00	1 16	.029	1 16	.030	1 4	1 27 64	1.750	4.00
00-40	00	1 8	.0635	1 16	.040	1 4	1 23 64	1.750	4.00
00-50	00	3 16	.0975	1 16	.050	1 4	1 19 64	1.750	4.00
00-60	00	1 4	.131	1 16	.060	1 4	1 19 64	1.750	4.00
00-80	00	3 8	.1985	1 16	.080	1 4	1 15 16	1.750	4.00
0-60	0	3 8	.1935	3 32	.060	5 16	1 5 8	2.250	4.50
0-80	0	1 2	.261	3 32	.080	5 16	1 5 8	2.250	4.50
0-90	0	5 8	.3265	3 32	.090	5 16	1 5 8	2.250	4.50
2-60	2	3 8	.1935	1 8	.060	3 8	2 7 32	3.000	5.60
2-90	2	5 8	.3265	1 8	.090	3 8	2 7 32	3.000	5.60
2-125	2	1	.5234	3 32	.125	3 8	1 29 32	3.000	5.60
2-156	2	1	.5318	3 32	.156	3 8	1 29 32	3.000	5.60

LOOK
TO
MASTERFORM
FOR BOTH STOCK SIZES AND *Special* TO ORDER CUTTING TOOLS



DOVETAIL FORMING TOOL

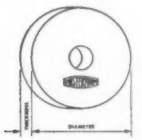
CIRCULAR FORMING TOOL

HIGH SPEED CIRCULAR TOOL BLANKS

FOR FORMING AND CUTTING-OFF TOOL USE

Made from a selected grade high speed steel, these tools are for use on circular cross slide tool posts of Brown & Sharpe automatic screw machines. These blanks are turned, drilled and tapped to fit tool post clamping screws. Blanks are either furnished soft as machined, or hardened and ground on two sides.

When ordering, please specify whether hard or soft blanks are desired, also diameter or machine number and thickness. Carried in stock for prompt shipment.



Tool blanks for other makes of screw machines can be furnished on special order.

FOR MACHINE NUMBER	DIA. INCHES	THICKNESS INCHES	NET PRICES SOFT BLANKS 1-6	SOFT BLANKS 7-12	HARD BLANKS 1-6	HARD BLANKS 7-12
00,00G,19 AUTO	1 3/4	1/4 to 3/8 by 16ths	1.15	1.10	1.45	1.41
00,00G,19 AUTO	1 3/4	7/16 to 5/8 by 16ths	1.35	1.30	1.71	1.65
00,00G,19 AUTO	1 3/4	11/16 to 7/8 by 16ths	1.75	1.70	2.20	2.15
00,00G,19 AUTO	1 3/4	15/16 to 1 by 16ths	1.80	1.75	2.25	2.20
0 and 0G AUTO	2 1/4	1/4 to 3/8 by 16ths	1.30	1.25	1.67	1.61
0 and 0G AUTO	2 1/4	7/16 to 5/8 by 16ths	1.75	1.70	2.22	2.15
0 and 0G AUTO	2 1/4	11/16 to 7/8 by 16ths	2.15	2.10	2.75	2.68
0 and 0G AUTO	2 1/4	15/16 to 1 1/8 by 16ths	2.45	2.40	3.18	3.10
2 and 2G AUTO	3	1/4 to 3/8 by 16ths	1.80	1.75	2.24	2.17
2 and 2G AUTO	3	7/16 to 5/8 by 16ths	2.50	2.45	3.14	3.06
2 and 2G AUTO	3	11/16 to 7/8 by 16ths	3.15	3.10	4.00	3.92
2 and 2G AUTO	3	15/16 to 1 1/4 by 16ths	3.65	3.60	4.65	4.57

LARGER AND SPECIAL SIZES FURNISHED ON SPECIAL ORDER
UNLESS OTHERWISE SPECIFIED, SOFT BLANKS WILL BE FURNISHED

MASTERFORM TOOL CO.

2552 IRVING PARK ROAD • CHICAGO 18, ILL.

Manufacturer and Designer of

Circular, Dovetail and Flat Forming Tools
Counterbores
Cut-Off Tools
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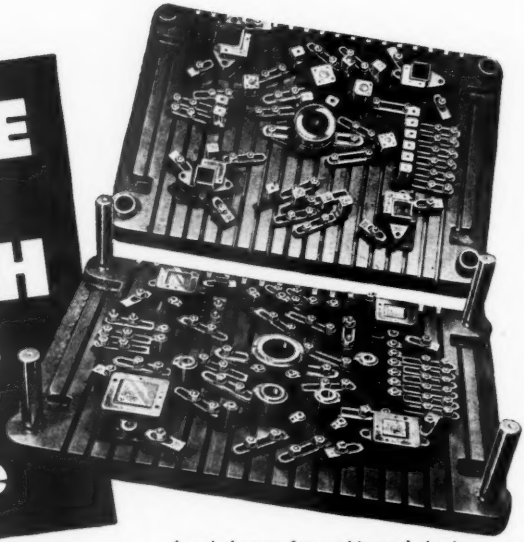
Reamers
Forming Tool Blanks
Cast Metal Alloy Tool Bits & Associated Products

ORDER FROM OUR FACTORY REPRESENTATIVE
(There's one near you)
OR FROM US

PIERCE and NOTCH at the same time

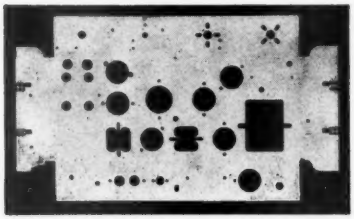


A typical set-up for notching and piercing.

with

WHISTLER
MULTI-USE Adjustable Dies

Pierced and notched with Whistler multi-use adjustable dies.



You save press time and speed production by combining corner notching dies and group dies in the same set-up with adjustable piercing dies. Press operations are reduced to a minimum. Engineering changes effecting relocation or sizes of holes can be made without delay right on the press.

Whistler multi-use adjustable dies are available from stock...a day or two from your plant...in all standard sizes from 1/32" to 3" diameters...round, square, ovals and rectangles. Notching and group dies to order. In addition to mighty attractive savings in original die costs there is this important advantage of eliminating weeks of production delay.

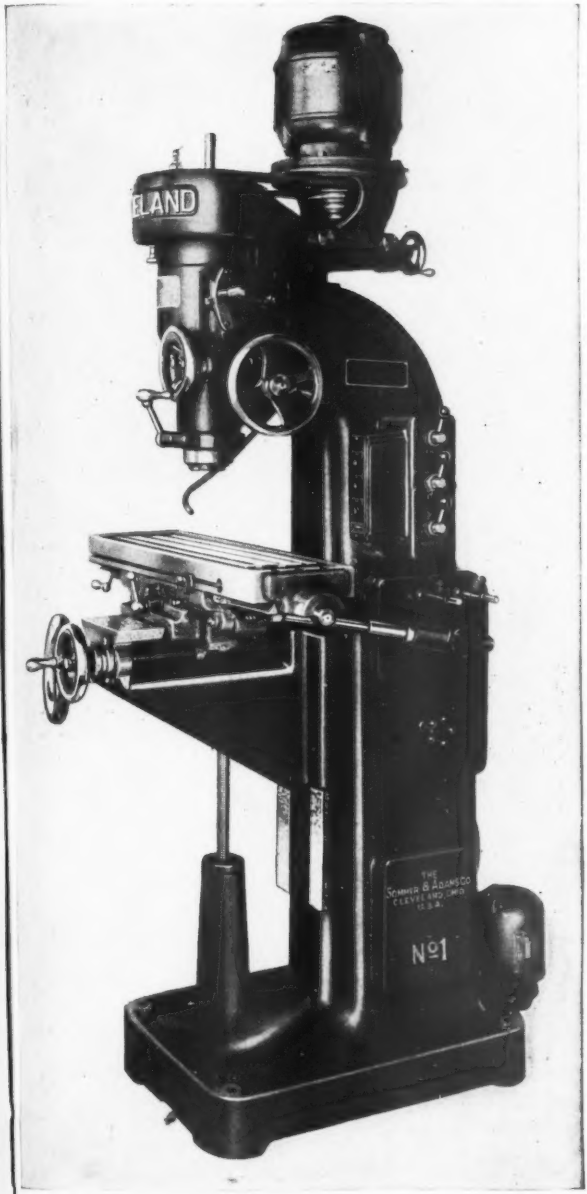
Re-arrange Whistler multi-use adjustable dies in as many different set-ups as your production calls for...you actually make up die sets from units in stock and reduce costs per job to an unbelievably low figure. All parts of like size are interchangeable.

Get all the facts on how Whistler adjustable dies can speed *your* production...cut *your* costs. Write today for the Whistler Catalogs.

S. B. WHISTLER & SONS, INC.
752-756 MILITARY ROAD BUFFALO 17, N. Y.

WHISTLER MULTI-USE ADJUSTABLE PERFORATING DIES

"PROFITABLE TO INSTALL BECAUSE THEY PERFORM SO MANY JOBS SO WELL . . ."



Cleveland No. 1 Vertical Milling Machine

Cleveland Vertical Milling Machines

Tool rooms, die and mold shops and production plants find the Cleveland No. 1 High Speed Vertical Milling Machine (shown at left) an exceptionally useful tool. This is primarily due to its simplicity, solid trouble-free construction and adaptability to a wide variety of fast precision work. It fills special needs that ordinary millers just do not fit. The cutter capacity of this model is from 1/16" to 2 1/2" mills. The milling table work surface is 8" by 32" . . . longitudinal travel 18", vertical travel 16", cross travel 8". There are twelve separate table feeds.

The spindle is solidly constructed of chrome-nickel steel, mounted on precision bearings. Spindle speeds 100 to 1800 rpm, with twelve selections. All lead screws and feed gears are mounted on Timken bearings, smooth and quiet in operation. There is a coolant pump in the machine base. Pump is optional equipment.

This is one of several widely popular standard products of The Sommer & Adams Company, whose specialty for more than thirty years has been engineering and custom building precision equipment for many purposes.

Let us send you bulletin TJ

The Sommer & Adams Company

18511 Euclid Avenue

Cleveland 12, Ohio

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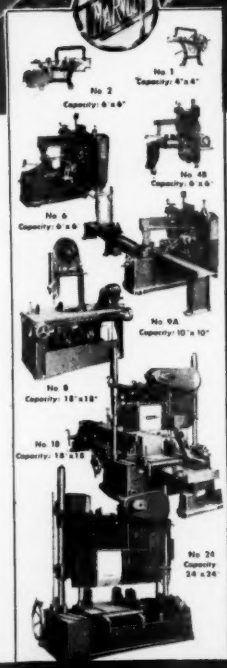

EASILY CUT-OFF TOUGHEST STEEL

Steels just don't come too tough for MARVEL Giant Hydraulic Hack Saws. Take, for example, the three No. 18 MARVEL Saws, at the Babcock & Wilcox steel mill, shown above. These machines are used to cut test specimens for sample pieces of stainless and other tough alloy billets which are checked for seams, pipes, etc., before being drawn into tubing. It takes tough steel to make the best tubing, and it takes modern sawing equipment to cut it rapidly, accurately and economically.

With 10 types of metal-cutting saws, each available in a series of variations, MARVEL can furnish sawing machines that exactly meet your requirements. If you have a metal-sawing problem—call in the local MARVEL Sawing Engineer.

Write for MARVEL Catalog or check it in your Sweet's Catalog Files.

MARVEL SAWS

ARMSTRONG-BLUM MFG., CO.

"The Hack Saw People"

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Eastern Sales Office: 225 Lafayette St., N.Y., 12